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Footed tones and tonal feet: rhythmic constituency in a pitch accent language

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The focus of this paper is a hybrid prosodic system which includes both tone and metrical structure, found in the Neo-štokavian dialect of Serbian or Croatian (henceforth NS). NS exhibits complex interactions between tone and foot structure, which can be nicely elucidated in terms of Optimality Theory, a constraint-based framework in which constraints may vary in strength, and therefore override each other. The proposed analysis brings out, and accounts for, the observed tension between the tonal and metrical components. This case is of immediate theoretical relevance for establishing the range of possible foot inventories. The resulting inventory is richer than in cases generally reported in the theoretical literature, and as such suggests a possible direction in which foot inventories may expand.

While prosodic systems are typically either tonal or metrical, composite systems including both tone and metrical structure present yet another, albeit less frequent, possibility (Prince 1983; Hayes 1995). The focus of this paper is a prosodic system of the latter, more complex variety, evidenced in the Neo-štokavian dialect of Serbian or Croatian (henceforth NS). Although previously analyzed as a pitch accent system with no role allotted to the rhythmic structure (Browne and McCawley 1965; Halle 1971; Ivić 1965, 1976; Kenstowicz 1974; Lehiste and Ivić 1986; Inkelas and Zec 1988), on closer inspection, NS discloses important resemblances with stress systems. Metrical structure is an independent agent in NS, as will be demonstrated here, and the entire prosodic system is characterized by a rich interplay between the tonal and metrical components.

Co-presence of tone and foot structure may in principle result in several types of interfaces between these two components. Cases documented in the literature are of two types: those in which the distribution of tone is constrained by metrical constituency, and those in which constraints operate in the opposite direction[1]. The former type is exemplified by a number of languages extensively discussed in the literature: Creek (Haas 1977; Halle and Vergnaud 1987; Hayes 1995), Seneca (Prince 1983:82-86), Winnebago (Susman 1943; Miner 1979, 1981, 1991; Halle and Vergnaud 1987; Hayes 1995 and the references therein) and Ancient Greek (Golston 1989; Sauzet 1989). The other type of unilateral interactions, with the rhythmic structure dependent upon the

[1] A third type of case has also been documented. In Japanese, as analyzed in Poser (1984, 1990), the accentual system is tonal in nature, while various templatic phenomena call for an inventory of iambic feet, yet the two systems are independent of each other and do not interact.

distribution of tone, is instantiated, for example, by Golin (Bunn and Bunn 1970; Hayes 1995).

In contrast, NS presents a case of *bilateral* interactions between tone and foot structure: tone exerts influence on the repertory of feet, and foot structure, in turn, constrains the distribution of tone. Although previously analyzed as an instantiation of unilateral interactions, on a par with Golin (Inkelas and Zec 1988; Hayes 1995), new evidence to be presented here clearly disputes this position. This case is of immediate theoretical relevance for establishing the range of possible foot inventories. The resulting inventory is richer than in cases generally reported in the theoretical literature (Prince 1990; Hayes 1995; Mester 1994), and as such suggests a possible direction in which foot inventories may expand.

The account of the interface between tone and foot structure in NS is cast within Optimality Theory (Prince and Smolensky 1993; McCarthy and Prince 1993a), a constraint-based framework within which the complex array of NS facts to be presented here is elucidated in an intuitive fashion, due to the recourse to minimal constraint violation; no comparable result is available in a rule-based approach. The NS prosodic system is accounted for by positing independent sets of constraints that govern the tonal and metrical components. Complex interactions across (as well as within) these two independent sets are captured in terms of constraint ranking: constraints are violable in this framework, which accounts for surface departures from otherwise robust generalizations, attributed to the pressure of higher ranking constraints. Another aspect of the framework relevant in this context is parallelism, which excludes sequential evaluation of candidate forms; this will play an important role in characterizing the distribution of tone, which had previously been captured by cyclic rule application. Moreover, the interface between the tonal and metrical systems is captured by invoking the theory of Generalized Alignment (McCarthy and Prince 1993b), a set of principles governing various types of interfaces among distinct components within the grammar, reducing them to adjustment of constituent edges. The proposed analysis brings out, and accounts for, what will be interpreted here as tension between the tonal and metrical systems.

The paper proceeds as follows: In section 1, I propose the NS foot inventory, which is shown to interact in interesting ways with tone. Next, I present an analysis of the tonal phenomena (section 2), and then turn to arguments for the proposed foot inventory, based on evidence coming from prosodic morphology (section 3). At least in part, stress as well is regulated by metrical structure. In section 4 I address the distribution of stress, which is

shown to be governed by the same inventory of feet that is relevant for the prosodic morphology. Concluding remarks are given in section 5.

1. Proposal: the NS inventory of feet

Descriptively, the NS prosodic system includes both tone and stress, with pitch and duration, respectively, as their relevant phonetic correlates (Lehiste and Ivić 1986). In the following phonological representations, the four NS pitch accents described in the traditional sources are represented in terms of High and Low tones, with the place of stress marked by an asterisk.

(1) a. Short Rising:

```
   *
marama
 \/  |
  H  L
```

b. Short Falling:

```
   *
kućica
 |  |/
 H  L
```

c. Long Rising:

```
    *
raazlika
 |  \|  |
 L  H  L
```

d. Long Falling:

```
   *
raadnica
 |  \|/
 H   L
```

These representations capture the phonetic properties of the pitch accents relevant for the phonology. As noted in Lehiste and Ivić (1986), pitch prominence is found on the only syllable bearing a falling accent, and on the two syllables associated with the rising accents. That tone is playing a significant role in the phonology is supported by the tonal interactions of the familiar sort (studied in Inkelas and Zec 1988; Zec 1988, 1992, 1993). The fact that, in addition to tone, words also receive stress, should naturally suggest that metrical structure is another independent component, parallel with tone, and this is the position I pursue in this paper.

I argue that, in addition to an elaborate tonal system, NS possesses metrical structure, which governs several types of prosodically-driven phenomena, and is ultimately responsible for the distribution of stress. It is further argued that metrical structure interacts in crucial ways with tone; although distinct, the two systems are closely interrelated.

The formal facets of this proposal are as follows: NS possesses a trochaic foot system, which includes the standard feet in (2):

(2) a. $[\ \sigma_{\mu\mu}\ ]_{\Phi}$
b. $[\ \sigma_{\mu}\ \sigma_{\mu}\ ]_{\Phi}$

The lower bound of at least two moras is captured by the following constraint on grouping within rhythmic units, following Prince and Smolensky (1993:47). (See also Prince 1980, 1990; McCarthy and Prince 1986, 1993a; Kager 1989, 1991; Mester 1994; Hayes 1995):

(3) Foot Binarity: Feet are binary at some level of analysis (μ or σ).

In addition, syllables associated with tone, both light and heavy, are also granted the foot status:

(4) a. $[\ \sigma_{\mu\ \mu}\ ]_{\Phi}$ (H on the first μ)
b. $[\ \sigma_{\mu}\ ]_{\Phi}$ (H on μ)

This is due to the following additional constraint that governs the NS foot inventory:

(5) FootSalience: Feet are associated with tone.

But on what grounds are the foot types listed in (2) and (4) members of a single inventory? There is a clear point of contact between the two types of configurations, which suggests that they both fall under the trochaic foot type. A peculiarity of this inventory is that tone is subject to conditions on foot structure, to be stated as an alignment constraint: a High tone may be associated only with the head of a foot, as in (6):

(6) Tone-to-Foot Alignment: Align High tone with the head of the foot.

In a trochaic system, this translates into the requirement that a High may only be aligned with the mora corresponding to the leftmost branch of a foot[2]. The foot type in (4a) is clearly in compliance with (6). The type in (4b), however, requires further elucidation.

A monomoraic syllable corresponds to a licit foot if associated with tone, as in (4b). Thus, while the monomoraic (that is, degenerate) foot in (7a) is not a possible foot type, that in (7b) is, by virtue of tonal association.

(7) a. *[μ]Φ b. [μ]Φ
H

While it is plausible to assume that High tones are licensed by the head of a foot, a further conjecture appears to be warranted: that a High may single out the mora it associates with *as* the foot's head, and by virtue of this, what would have otherwise been an illicit foot, becomes a headed structure. It is thus necessary to recognize that the foot in (7b) is headed and therefore wellformed, while the one in (7a) is illformed because it is not headed. In sum, for a syllable to form a licit foot, it either has to be bimoraic, or aligned with tone, or both.

Foot Binarity, we will assume, insures that a foot possesses a head. The same function may be attributed to tonal association: the mora associated with tone acts as the foot's head, albeit potentially of the nonrelational sort (and as such reminiscent of the type of head proposed in Hammond 1984/88). The presence of tonal association is in fact sufficient to endorse a foot, which otherwise would fail on the Foot Binarity requirement. To conclude, in a hybrid system like this one, both grouping and prominence are relevant, and the requirement that a foot should be headed may be satisfied in more than one fashion, either by virtue of FootBinarity or FootSalience.

Note however that FootBinarity and FootSalience do not impose absolute requirements; while FootBinarity is violated by the monomoraic tonal foot in (4b), FootSalience is violated by the "regular" trochaic feet in (2). Moreover, these two constraints do not exclude the foot types in (8) and (9), yet these are entirely absent from the system:

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[2] While this constraint is also statable as edge alignment, I state it here as head alignment. As noted in McCarthy and Prince (1993b), the choice of head is already a case of edge alignment, and it is no accident that in a trochaic system tone is subject to an alignment constraint consistent with headedness. Incidentally, this constraint may be violated under the pressure of higher ranking constraints, as will be seen in section 4.

(8) $[\ \sigma_{\mu\mu}\ \sigma_{\mu}\ ]_{\phi}$

(9) $[\ \underset{H}{\sigma_{\mu}}\ \sigma_{\mu}\ ]_{\phi}$

In order to exclude (8), we need a ban on uneven trochees, which is stated in (10), following Prince 1990:359 (where |X| stands for "size of X")[3]:

(10) Trochaic Quantity:
In a rhythmic unit [S W], |S| = |W|

Under a proper interpretation, (10) bans not only (8) but also (9). Grouping two unequal syllables, either in terms of mora count or tonal association, is sufficient to produce an uneven trochee. In fact, under this interpretation, the foot type in (4a), which includes two unequal moras, one with and the other without tonal association, fails to satisfy TrochaicQuantity, as well.

In sum, the NS foot inventory includes the foot types in (11), which play an important role both in prosodic morphology and stress. (This inventory is established on empirical grounds, as will be seen later in the paper.) Note that none of the foot types observes all constraints on the foot inventory. Which of the types is selected at any point will crucially depend on the ranking of the proposed constraints.

(11) Foot inventory:

	FootBinarity	FootSalience	TrochaicQuantity
a. $[\ \sigma_{\mu\mu}\ ]$		*	
b. $[\ \sigma_{\mu}\ \sigma_{\mu}\ ]$		*	
c. $[\ \underset{H}{\sigma_{\mu}}\ ]$	*		
d. $[\ \underset{H}{\sigma_{\mu\mu}}\ ]$			*

The repertory of feet in (11) constrains the phonological constituency on two grounds: first, tones have to be parsed in compliance with the foot repertory, and second,

[3] See Hayes (1995) for arguments that trochees are preferably even.

the parsing of syllables into feet has to "work around" the parsed tones, again in compliance with the repertory in (11). Certain departures from this inventory are possible, and will be treated as constraint violations.

The facts to be analyzed in this paper are sufficiently complex to call for positing two distinct phonological levels, corresponding to the lexical/postlexical division within the lexical phonology and morphology (Kiparsky 1982, 1984). One of the levels, the MLevel, houses phonology-morphology interactions, the other, the SLevel, houses phonology-syntax interactions. Sections 2 and 3 deal with the phenomena at MLevel, and section 4 focuses on SLevel.

2. The distribution of tone

Tone forms a self-contained system, in most respects independent of metrical structure. It will be demonstrated in this section that High tones exhibit the tendency to dock as close to the word's right edge as possible. In this, the tonal system differs conspicuously from stress which, as will be shown in section 4, tends towards the word's left edge, and ideally, towards its leftmost syllable.

The account of tone to be presented here follows in part the (cyclic) analysis in Zec (1988, 1992), specifically, the interpretation therein of the phonology/morphology interactions, but is recast in noncyclic, or rather, nonderivational terms. The complex interactions between tone and the morphological constituency are captured without resort to devices such as phonology/morphology interleaving or the cycle. What I present here is not a reanalysis of the entire tonal system, but rather, of its central traits, which are of immediate relevance to the discussion at hand.

Although the pitch properties of NS words need to be represented in terms of both High and Low tones, only the Highs play a role in lexical representations (Inkelas and Zec 1988). Moreover, the distribution of Highs in NS is to a large extent predictable, which justifies representing tone as unlinked, that is, floating (as argued in Zec 1988, 1992, 1993). Lexical forms (both stems and affixes) may be either toneless or affiliated with a High tone, as schematized in (12) an (13):

(12) Lexical representations of stems:

a. [stem] b. [stem]
H

(13) Lexical representations of affixes:

c. [affix] d. [affix]
H

Morphological constituency is highly relevant for determining the docking site of floating Highs. Here, I propose that NS words are parsed into three layers of morphological constituents, all residing within the MLevel --- M1, which corresponds to bare stems as well as forms derived by a designated class of derivational suffixes, henceforth M1 suffixes; M2 constituent, which comprises forms derived by another designated class of derivational suffixes, M2 suffixes; and finally, the word, MW, which results from combining a simplex or derived stem with an inflectional suffix. The three layers of morphological constituency are shown, again schematically, in (14).

(14) $[\,[\,[\,[\,[\,[\,\text{stem}\,]_{M1}\ \text{suff}_{M1}\,]_{M1}\ \ldots\,]_{M1}\ \text{suff}_{M2}\,]_{M2}\ \ldots\,]_{M2}\ \text{suff}_{INFL}\,]_{MW}$

Note that the bare stem corresponds to the M1 constituent, and so does a combination of the stem and a M1 suffix. The M2 constituent is created by a M2 suffix, and the MW constituent, by a MW suffix. Although the constituency in (14) is potentially recursive, it is not to be interpreted in this fashion. Rather, what corresponds to any given morphological constituent is its largest expansion, and none of the smaller expansions is relevant in any way.

The simplex stems listed in (15), toneless or endowed with tone, combine with the affixes in (16) to form morphologically complex entities. We focus here on the nominal and adjectival forms.

(15) Stems:

Toneless in UR		Affiliated with tone in UR	
dever- [m]	'brother-in-law'	harmonik- [f]	'harmonium'
meseec- [m]	'moon'	jelen- [m]	'deer'
led- [m]	'ice'	lan- [m]	'flax'
		junaak- [m]	'hero'
		sviil- [f]	'silk'

The affixes in (16a) belong to the M1 class, those in (16b) to the M2 class, and those in (16c) to the MW class. This subdivision of affixes is based in part on their tonal/accentual properties: M1 suffixes are dominant, while M2 and MW suffixes are recessive. Moreover, any content word has to include exactly one inflectional suffix, i.e., a suffix of the MW class[4].

[4] Here we focus only on the suffixes. Those listed in (16) are the only suffixes used in the examples throughout the paper. Note also that *A* stands for a yer vowel; more on this peculiar segment later in this, and the following, section.

(16) Affixes:

	Toneless in UR [unaccented]		Affiliated with tone in UR [accented]	
a. M1 suffixes (derivational)	- en	[adjective forming]	- ij - aaš	[forms comparative adjectives] [forms agentive nouns]
b. M2 suffixes (derivational)	- ov - ov - Ask - ost	[forms possessives] [nominal augment] [adjective forming] [noun forming]	- aar	[forms agentive nouns]
c. MW suffixes (inflectional)	- a, -e - A	[genitive singular] [nominative singular]		

A word is associated with a floating High tone if at least one of its constituent parts --- stem or affix --- introduces a High, and is toneless otherwise. Where the High will dock within a word depends then on several factors, morphological as well as phonological. On the phonological end, there is a strong pressure to parse tone, as stated in (17), yet this requirement is not absolute, since no more than one High is permitted per word; this is expressed in (18) as an OCP type of constraint.

(17) Parse H (TBU = mora)

(18) OCP: * [. . . . .]$_{MW}$
H H

Moreover, while the tone bearing unit is the mora, only a head mora may serve as a licit docking site, that is, the leftmost mora of a heavy syllable, and the only mora of a light syllable. This can be advantageously reduced to a case of illicit tone-to-foot alignment. Significantly, the configuration in (19) is excluded from the foot repertory in (11), since a High is not permitted on the nonhead branch of a foot:

(19) Configuration prohibited by Tone-to-Foot Alignment: * [σ]$_{Φ}$
$μ_s μ_w$
H

In other words, operative here is the constraint on the alignment of tones and feet, stated in (4), which excludes configurations as in (19), in which tone links to the second mora of a heavy syllable (for our purposes heavy syllables are those that contain long vowels). We thus see a case, one among several to be documented here, of tone and foot structure directly interacting with each other.

It will be shown below that OCP ranks over ParseH; this achieves the desired result of having at most one High tone per word. There is no evidence for ranking Tone-to-Foot either with respect to OCP or ParseH,

In addition to being constrained phonologically, tone docking is also governed by a set of morphological constraints, to be stated in terms of the morphological constituents proposed above --- M1, M2, and MW. First, tone is preferably parsed within the morphological constituent in which it originates. Second, only moras located at the right edge of a morphological constituent serve as docking sites for High tones. The entire system is fairly baroque, and we focus here on a subset of forms, those with tones introduced by a M1 element. In this case, the High will optimally dock onto the rightmost mora within M1, otherwise, it will aim at the edge of the next larger constituent, that is, M2, and ultimately, MW[5].

This set of properties will again be captured by constraining the alignment between the mora associated with the lexical High and the morphological constituents --- M1, M2, and MW, adopting the principles of Generalized Alignment in McCarthy and Prince (1993b). Constraints (20), (21), and (22) state that the preferred docking target for a High (introduced by a M1 element) is the right edge of M1, M2, and MW, respectively. These constraints are stated as the alignment of a mora associated with a High tone, and ranked as in (23), expressing the order of preference for each of the constituents to receive a High originating in M1.

(20) AlignM1: Align (μ_H, R, M1, R)

(21) AlignM2: Align (μ_H, R, M2, R)

(22) AlignMW: Align (μ_H, R, MW, R)

(23) Ranking: AlignM1 >> Align M2 >> Align MW

High tones are thus subject to dual alignment conditions --- phonological as well as morphological. Moreover, the block of phonological constraints on tone docking ranks higher than the block of morphological constraints, as stated in (24). Morphological conditions thus yield to the phonological ones, a situation which parallels the finding of McCarthy and Prince (1993a) for Axininca Campa.

(24) Phon (OCP, ParseH, Tone-to-Foot) >> Morph (AlignM1, AlignM2, AlignMW)

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[5] The conclusions drawn on the basis of these cases carry over to the entire system. For a more detailed treatment, see Zec (1988, 1992).

In order to illustrate the functioning of the proposed constraints, we first look at morphologically complex forms derived from a simplex stem endowed with tone, as in (25). In (25a), this stem combines only with an inflectional toneless suffix; in (25b), it combines with a derivational M1 suffix, and in (25c) with two derivational M1 suffixes. Regardless of whether the suffixes in (25a-c) are toneless or not, the output form invariably has a High on the rightmost mora of M1; in (25a), this is the only mora of the stem, in (25b), the suffix *-en*, and in (25c), the suffix *-ij*. The fact that *-en* is toneless, while *-ij* has tone of its own, is irrelevant for tone docking, as long as at least one element within the morphologically complex form brings in a High tone.

(25) a. lan]$_{M1}$ a]$_{MW}$ (H) — lána — 'flax[Gen,Sg]'

b. lan]$_{M1}$ en]$_{M1}$ a]$_{MW}$ (H) — lanéna — 'flaxen[Nom,Sg,Fem]'

c. lan]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$ (H H) — lanenija — 'more flaxen[Nom,Sg,Fem]'

How do the constraints proposed above account for these cases? We start with the derived stem in (25b), which contains a M1 and a MW suffix. Constraints relevant in this case are ParseH, AlignM1 and AlignMW; the fact that only one High needs to be parsed makes the OCP constraint irrelevant here.

(26) Input: lan]$_{M1}$ en]$_{M1}$ a]$_{MW}$ (H)

	Parse H	AlignM1	AlignMW
» a. lanén]$_{M1}$ a]$_{MW}$			*
b. lánen]$_{M1}$ a]$_{MW}$		* !	*
c. lanen]$_{M1}$ á]$_{MW}$		* !	
d. lanen]$_{M1}$ a]$_{MW}$	* !		

The form in (26d) is ruled out since the High has not been parsed. The remaining three forms compete as to which of the syllables is the optimal target for the High. The best-formed output is (26a), with the High on the rightmost mora within M1. (26c) is ill-formed because the High is parsed outside M1, and (26b), because the High docks on a non-final syllable within M1. Finally, note that the well-formed (26a) violates AlignMW, which shows that this constraint ranks lower than AlignM1.

Unlike (25b), (25c) possesses two floating Highs, which brings in the OCP constraint. As shown in the following tableau, any form with only one of the Highs parsed is better than a form in which both Highs are parsed; OCP thus ranks higher than ParseH.

(27) Input: lan]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{W}$
H H

	OCP	Parse H
a. lanenij]$_{M1}$ a]$_{MW}$	√	√ *
b. lánenij]$_{M1}$ a]$_{MW}$	√	√ *
c. lanenij]$_{M1}$ á]$_{MW}$	√	√ *
d. lánenij]$_{M1}$ a]$_{MW}$	* !	√ √
e. lanenij]$_{M1}$ á]$_{MW}$	* !	√ √

The candidate outputs with only one of the Highs parsed are then evaluated in exactly the same fashion as in (26). Again, the optimal target for the floating High is the rightmost syllable within M1, as is the case in the well-formed (28a).

(28) Input: lan]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$
H H

	Parse H	AlignM1	AlignMW
» a. lanenij]$_{M1}$ a]$_{MW}$	√ *		*
b. lanénij]$_{M1}$ a]$_{MW}$	√ *	* !	*
c. lánenij]$_{M1}$ a]$_{MW}$	√ *	* !	*
d. lanenij]$_{M1}$ á]$_{MW}$	√ *	* !	
e. lanenij]$_{M1}$ a]$_{MW}$	* *!		

The next type of case we turn to is that of a toneless stem like *led* 'ice', which produces a toneless form when combined with a toneless suffix, as in (29a) or (29b); the derived form in (29c) is affiliated with tone since one of its constituent parts, the suffix *-ij*, brings in a tone of its own. As a result, the output in (29c) has tone on the final mora in M1, while (29a) and (29b) remain toneless.

(29) a. led]$_{M1}$ a]$_{MW}$ leda 'ice[Gen,Sg]'

b. led]$_{M1}$ en]$_{M1}$ a]$_{MW}$ ledena 'icy[Nom,Sg,Fem]'

c. led]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$ ledenija 'icier[Nom,Sg,Fem]'
H

Among the forms in (29), only the form endowed with a High, that is, (29c), is relevant in the present context. As shown in (30), the evaluation of its candidate output forms follows the same course as in tableau (28), the only difference being that the complex form in (29c) possesses only one floating High that needs to be parsed.

(30) Input: led]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$
H

	Parse H	AlignM1	AlignMW
» a. ledeníj]$_{M1}$ a]$_{MW}$			*
b. ledénij]$_{M1}$ a]$_{MW}$		* !	*
c. lédenij]$_{M1}$ a]$_{MW}$		* !	*
d. ledenij]$_{M1}$ á]$_{MW}$		* !	
e. ledenij]$_{M1}$ a]$_{MW}$	* !		

In all the cases we have looked at thus far, the High invariably docks within M1. The reason for this is that Tone-to-Foot, the constraint that prohibits Highs on the foot's nonhead branch, has been duly observed, since M1 has regularly ended in a light syllable. If the final syllable in M1 is heavy (i.e., contains a long vowel), the M1-final mora cannot serve as the target of the floating High, since this would result in a violation of Tone-to-Foot. This is the case in (31), in which the stem *sviil-* 'silk' contains a long vowel. In (31a), the only syllable of the stem occupies the final position within M1 and, as a consequence, the floating High docks on the syllable immediately following the stem, which in this case is an inflectional suffix. (The forms in (31b) and (31c) are in full observance of Tone-to-Foot, since in both cases M1-final syllable is light.)

(31) a. sviil]$_{M1}$ a]$_{MW}$ sviilá 'silk[Nom,Sg]'
H

b. sviil]$_{M1}$ en]$_{M1}$ a]$_{MW}$ sviiléna 'silky[Nom,Sg,Fem]'
H

c. sviil]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$ sviileníja 'silkier[Nom,Sg,Fem]'
H H

Note the minimal difference between the forms in (25) and those in (29); while we see a clear parallelism in tone docking between (25b) and (31b), as well as (25c) and (31c), this is not the case with (25a) and (31a), repeated in (32).

(32) Minimal contrast between (27a) and (33a):

a.	lan]$_{M1}$ a]$_{MW}$ H	lána	'flax[Gen,Sg]'	(25a)
b.	sviil]$_{M1}$ a]$_{MW}$ H	sviilá	'silk[Gen,Sg]'	(31a)

The tableaux in (33) and (34) bring out clearly the minimal contrast between the forms in (32). While in (33) tone may dock on the M1-final mora, as shown by the well-formed (35a), this is not the case in (34). In (34c), the High docks on the final mora in M1, but this violates Tone-to-Foot. The well-formed (34a) has tone at the right edge of the MW, which in this case is the next available morphological constituent.

(33) Input: lan]$_{M1}$ a]$_{W}$
H

	Parse H	Tone-to-Foot	AlignM1	AlignMW
» a. lán]$_{M1}$ a]$_{MW}$				*
b. lan]$_{M1}$ á]$_{MW}$			* !	
c. lan]$_{M1}$ a]$_{MW}$	* !			

(34) Input: sviil]$_{M1}$ a]$_{MW}$
H

	Parse H	Tone-to-Foot	AlignM1	AlignMW
» a. sviil]$_{M1}$ á]$_{MW}$			*	
b. svíil]$_{M1}$ a]$_{MW}$			*	* !
c. sviíl]$_{M1}$ a]$_{MW}$		* !		*
d. sviil]$_{M1}$ a]$_{MW}$	* !			

The situation in (34) is replicated if the heavy syllable in M1-final position belongs to a suffix. This is illustrated in (35): in (35a) we see a root possessing a lexical High, which docks on the root-final syllable, since this is also a final syllable within M1; when this root combines with a M1 suffix whose only vowel is long, the High docks outside the M1 constituent.

(35) a. harmonik]$_{M1}$ a]$_{MW}$ harmoníka 'accordion(Nom,Sg)'
H

b. harmonik]$_{M1}$ aaš]$_{M1}$ a]$_{MW}$ harmonikaašá 'accordion player(Gen,Sg)
H H

As shown in (36), the High that fails to dock within M1 shows a steady tendency towards the word's right edge.

(36) Input: harmonik]$_{M1}$ aaš]$_{M1}$ a]$_{MW}$
H H

	Parse H	Tone-to-Foot	AlignM1	AlignMW
» a. harmonikaaš]$_{M1}$ á]$_{MW}$			*	
b. harmonikaáš]$_{M1}$ a]$_{MW}$		* !		*
d. harmoníkaaš]$_{M1}$ a]$_{MW}$			*	* !
e. harmonikaaš]$_{M1}$ a]$_{MW}$	* !			

However, the tendency towards the right edge of the word is hindered by the presence of a M2 morphological constituent, as shown in (37). Note that, when a toneless M2 suffix is present, it is this suffix rather than the MW suffix that serves as the target of tone docking.

(37) harmonik]$_{M1}$ aaš]$_{M1}$ ev]$_{M2}$ a]$_{MW}$ harmonikaaševa 'accordion player's'
H H

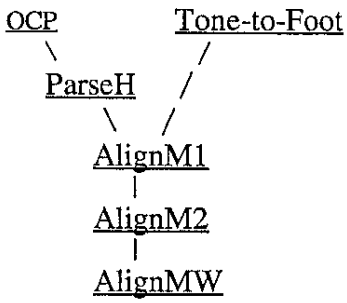
This effect is attributed to the AlignM2 constraint, as demonstrated in the following tableau:

(38) Input: harmonik]$_{M1}$ aaš]$_{M1}$ ev]$_{M2}$ a]$_{MW}$
H H

	Parse H	Tone-to-Foot	AlignM1	AlignM2	AlignMW
» a. harmonikaaš]$_{M1}$ év]$_{M2}$ a]$_{MW}$			*		*
b. harmonikaaš]$_{M1}$ ev]$_{M2}$ á]$_{MW}$			*	* !	
c. harmoníkaaš]$_{M1}$ ev]$_{M2}$ a]$_{MW}$			*	* !	*
d. harmonikaáš]$_{M1}$ ev]$_{M2}$ a]$_{MW}$		* !		*	*
e. harmonikaaš]$_{M1}$ ev]$_{M2}$ a]$_{MW}$	* !				

Thus far we have accounted for the behavior of forms that possess a High tone introduced by a M1 element. The mutual ranking among the phonological and morphological constraints on tone docking is summarized in (39):

(39)



While tone introduced by a M2 or MW element brings in some further peculiarities, the general picture presented above remains essentially unaltered. Stated briefly, a High introduced by a M2 element will dock either within M2 or onto a MW element, and a MW High may only be parsed onto a MW element. Again, the High exhibits a steady tendency towards the word's right edge. And again, the set of morphological constraints on docking are dominated by the phonological set.

It is important to address at this point the issue of tone docking on the yer vowels, a class of unstable segments that play an important role in the vocalic systems of Slavic languages (see Lightner 1972; Gussman 1980; Rubach 1984; Kenstowicz and Rubach 1987; Szpyra 1992). It has been argued in Zec (1988, 1992, 1993) that the yer vowels are a possible target of High tones in NS. The evidence, although indirect, is quite solid, and rests on the general pattern of tonal distribution. Compare the tonal patterns of the following four sets of forms, belonging to the masculine declension class:

(40)

	'hero'	'deer'	'moon'	'brother-in-law'
Nom	junáak	jelén	meseec	dever
Gen/Acc	junaaká	jeléna	meseeca	devera
Dat	junaakú	jelénu	meseecu	deveru
Instr	junaakóm	jelénom	meseecom	deverom

While the forms for 'moon' and 'brother-in-law' are toneless, those for 'hero' and 'deer' possess lexical tone of their own, and we focus here on its docking site. The account of the oblique case forms is straightforward: in 'hero' the stem final mora is not a possible target for the High due to the Tone-to-foot constraint, so the High docks on the desinence; in 'deer' the high docks on the stem-final syllable, which is a licit target for

tone docking. The nominative form of 'deer' falls in line with the oblique forms, but the nominative form of 'hero' does not. Note that, the way we have things set up at this point, the High simply should not be able to dock on the final heavy syllable of 'hero', as it does in the actual form.

In order to have a unified account, we assume that the nominative singular, just like the other case forms, possesses a desinence, which in this case corresponds to a yer vowel. The High then docks on the desinence in all case forms of 'hero', including the nominative singular form, as shown in (40)[6]. While the yer is present at the MLevel, which we are focusing on here, it is eventually lost, or rather, it is absent form the SLevel, which we turn to in section 4.

(41) NomSg forms:

	'hero'	'deer'	'moon'	'brother-in-law'
MLevel	junaakÁ	jelénA	meseecA	deverA
SLevel	junáak	jelén	meseec	dever

But while the yer is lost, the High tone remains, and is realigned with what becomes the stem-final syllable. Note that the realignment is subject to the Tone-to-Foot constraint: the High docks on the mora that serves as the head of the foot. These, and other facts of this general sort (see Zec 1988, 1992, 1993, also section 3 below), strongly suggest that the yers are included in syllable structure at the MLevel. At the SLevel, which we focus on in section 4, the yers are no longer part of the picture, arguably because they are no longer admitted as syllable heads[7].

Finally, constraints on tone docking proposed here still do not fully account for the pitch properties of N-S words. Two more points are in order: first, a lexical High on a noninitial syllable is redundantly linked to the immediately preceding mora. Thus, forms like those in (42) are phonetically realized as in (43):

---

[6] In two out of four nominal declension classes, the masculine and one of the feminine declensions, the nominal singular ending corresponds to a yer vowel . The forms listed in (40) all belong to the masculine declension class.

[7] Some yers do remain though, and are realized as *a*. The conditions under which this happens are very much those identified by Szpyra (1992) for Polish, and her account may well extend to the NS facts. According to Szpyra, a yer is realized in order to salvage unsyllabifiable consonants; in our terms, under the pressure of the requirement to parse segments.

(42) a. led]$_{M1}$ en]$_{M1}$ ij]$_{M1}$ a]$_{MW}$ (H) ledenija 'icier[Nom,Sg,Fem]'

b. harmonik]$_{M1}$ a]$_{MW}$ harmonika 'accordion(Nom,Sg)'

(43) a. ledénija (H) b. harmónika (H) c. jéléna (H)

Second, a toneless form surfaces with a High on the word-initial mora.

(44) a. led]$_{M1}$ a]$_{MW}$ leda 'ice[Gen,Sg]'

b. led]$_{M1}$ en]$_{M1}$ a]$_{MW}$ ledena 'icy[Nom,Sg,Fem]'

(45) a. léda (H) b. lédena (H) c. méseeca (H) d. dévera (H)

Moreover, the leftmost High in (43) and (45) is concomitant with stress (as indicated by underlining the relevant syllable). These additional tonal facts are stress-driven, as will be argued in section 4. Note that, in both cases, the High gravitates towards the word's left edge, a tendency to be ascribed to stress, that is, to the metrical rather than the tonal system.

To summarize, we have seen that tone is largely subject to its own set of constraints, purely tonal, as well as morphologically-driven alignment constraints, with one notable exception: it is governed by metrical structure through the agency of Tone-to-Foot alignment, which permits tone docking only if the resulting configuration is a wellformed foot. But this situation may arise only if every syllable associated with tone is necessarily parsed as a foot, as already proposed in section 1. Moreover, this further suggests that a syllable with a yer vowel associated with a High also corresponds to a foot. That this is indeed the case is further corroborated by the role of foot structure in prosodic morphology, which is the focus of section 3.

3. Prosodic evidence for the foot inventory

Evidence for the foot repertory proposed in section 1 (repeated in (46)) comes from several types of prosodic size constraints[8].

[8] The data are taken from Leskien (1911, 1914), Matešić (1965-67, 1970), Nikolić (1970), Daničić (1925).

(46) Foot inventory:
without tone

a. $[\ \sigma_{\mu}\ \mu\ ]_{\Phi}$

b. $[\ \sigma_{\mu}\ \sigma_{\mu}]_{\Phi}$

with tone

c. $[\ \sigma_{\mu}\ \mu\ ]_{\Phi}$
H

d. $[\ \sigma_{\mu}\ ]_{\Phi}$
H

The types of morphological entities relevant here are, first, the constituents such as M1, M2, or MW (posited in section 2), which arise from morphological concatenation and reside at MLevel; and second, morphological entities which serve as classificatory principles within the lexicon, and are represented by the major classes such as nouns, verbs, or adjectives, as well as declensional and conjugational subclasses within the major classes.

Two of the size constraints documented here obtain at MLevel, constraints on M2 and MW constituents. The third one, a size constraint on one of the nominal declension classes, obtains within the lexicon. These prosodic size constraints provide positive evidence for the monosyllabic feet in (46a) and (46d), and also demonstrate that (46b) is the only admissible type of disyllabic foot. This section provides no direct evidence for the foot type in (46c). Such evidence will be furnished in section 4, which focuses on interactions at the SLevel.

The facts to be presented here demonstrate clearly that grouping is a crucial footing principle in toneless forms, while prominence prevails in forms with lexical tone. This follows from mutual interactions of the three constraints on foot inventory proposed in section 2. In particular, constraints on grouping, FootBinarity and TrochaicQuantity, outrank FootSalience, a prominence related constraint.

3.1 Prosodic constraint on the M2 constituent (or trochaic shortening)

We first turn to a size constraint on the M2 constituent, manifested as vowel shortening, and interpreted here as prosodically driven stem truncation. This case of truncation is triggered by a set of M2 suffixes, all of which are toneless and contain a short vowel. Both these properties are crucial in capturing the nature of the prosodic effect they trigger.

The pattern is illustrated with *-ost,* a toneless M2 suffix which combines with adjectives to form abstract nouns, and *-Ask,* an adjective forming suffix that contains a yer vowel[9]. These suffixes trigger vowel shortening in the immediately preceding syllable in only one case: when combined with a toneless base corresponding to a single heavy syllable, as in (47) - (48).

(47) *- ost* : $\sigma_{\mu\mu}$, toneless

Base		Gen.Sg		
a. luud-	ludost-	ludosti	'mad'	(cf. luuda)
b. tuup-	tupost-	tuposti	'blunt, obtuse'	(cf. tuupa)
c. žiiv-	živost-	živosti	'lively'	(cf. žiiva)
d. mlaad-	mladost-	mladosti	'young'	(cf. mlaada)
e. leenj-	lenjost-	lenjosti	'lazy'	(cf. leenja)
f. sveet-	svetost-	svetosti	'sacred'	(cf. sveeta)
g. gruub-	grubost-	grubosti	'calous'	(cf. gruuba)
h. blaag-	blagost-	blagosti	'gentle'	(cf. blaaga)
i. tiih-	tihost-	tihosti	'quiet'	(cf. tiiha)

(48) *- Ask* : $\sigma_{\mu\mu}$, toneless[10]

Base Nom.Sg				
a. graad-	gradAsk-	gradski	'city'	(cf. graada)
b. moor-	morAsk-	morski	'sea'	(cf. moora)
c. sveet-	svetAsk-	svetski	'world'	(cf. sveeta)
d. muuž-	mušAsk-	muški	'husband'	(cf. muuža)
e. kluub-	klubAsk-	klupski	'club'	(cf. kluuba)
f. vraag-	vragAsk-	vraški	'devil'	(cf. vraaga)
g. škool-	školAsk-	školski	'school'	(cf. škoola)
h. stiil-	stilAsk-	stilski	'style'	(cf. stiila)

No vowel shortening is encountered with toneless polysyllabic bases ending in a heavy syllable, as shown in (49) and (50):

[9] The yer vowel is not manifested in (48), because conditions for its vocalization are not met. Evidence for its presence in these forms comes from characteristic tonal patterns, as in (51) below (see note 11).

[10] A number of loan words may not lose vowel length in this fashion, as in *miitski /*mitski* (*miit-* 'myth'), *toonski/*tonski* (*toon-* 'tone'), *joonski/*jonski* (*joon-* 'ion'), *baarski/*barski* (*baar-* 'bar'), *plaanski/*planski* (*plaan-* 'plan'). It may well be that loan words are under a stricter ban against failure to parse a mora than forms in the native vocabulary.

(49) *-ost* : $\sigma_{\mu}\sigma_{\mu\mu}$, toneless

Base		Gen.Sg	
a. humaan-	humaanost-	humaanosti	'humane'
b. poznaat-	poznaatost-	poznaatosti	'familiar'
c. opaak-	opaakost-	opaakosti	'vicious'
d. sputaan-	sputaanost-	sputaanosti	'constrained'
e. pospaan-	pospaanost-	pospaanosti	'sleepy'

(50) *-Ask* : $\sigma_{\mu}\sigma_{\mu\mu}$, toneless

Base		Nom.Sg	
a. dinaar	dinaarAsk-	dinaarski	'dinar (currency)'
b. kurjaak	kurjaakAsk-	kurjaački	'wolf'

Nor is vowel shortening evidenced with bimoraic monosyllabic stems that are associated with tone, as in (51) and (52)[11].

(51) *-ost* : $\sigma_{\mu\mu}$, affiliated with tone

Base		Gen.Sg	
a. gluup- H	gluupóst-	gluupósti	'stupid'
b. kruut- H	kruutóst-	kruutósti	'inflexible'
c. blaag- H	blaagóst-	blaagósti	'soft, tender'
d. taajn- H	taajnóst-	taajnósti	'secret'
e. jaak- H	jaakóst-	jaakósti	'strong'
f. mlaak- H	mlaakóst-	mlaakósti	'lukewarm'
g. naagl- H	naaglóst-	naaglósti	'abrupt'

(52) *-Ask* : $\sigma_{\mu\mu}$, affiliated with tone

Base		Nom.Sg		
a. ruun- H	ruunÁsk-	rúunski	'wool'	(cf. ruunó)
b. Sreem- H	SreemÁsk-	Sréemski	(geogr.)	(cf. Sreemá)
c. viin- H	viinÁsk-	víinski	'wine'	(cf. viiná)
d. djaak- H	djaakÁsk-	djáački	'student'	(cf. djaaká)
e. Saav- H	SaavÁsk-	Sáavski	(geogr.)	(cf. Saavá)

[11] In (51) and (52), the High tone lands not on the base but on the suffix. However, in (52), the only vowel of the suffix is a yer, and the loss of the yer vowel at SLevel is accompanied by the retraction of the High tone to the preceding syllable. This is parallel to the facts in section 2 pertaining to the nominative singular ending that corresponds to a yer.

Finally, bases that end in a monomoraic syllable, regardless of their size or tonal association, remain invariant in their shape.

These facts suggest, first, that a prosodic size constraint is at work here, and second, that its target is the M2 morphological constituent, which has to correspond to a single foot, as stated in (53).

(53) M2 = Ft

Yet, the effect of this constraint is obviously not absolute. It is observed, in fact, only in (47) - (48), with toneless stems that correspond to a single heavy syllable. What makes these forms distinct is that the M2 stem can be reduced to a foot by virtue of one type of minimal adjustment: failure to parse a mora into syllable structure. This can be achieved by shortening the only syllable of the base, which reduces the M2 constituent to a single disyllabic foot, as in (54b) and (55b). Note that syllables headed by yer vowels are included into foot structure, just like those headed by "regular" vowels.

(54) a. [[luud]$_{M1}$ ost]$_{M2}$
b. [ludost]$_{M2 = Ft}$

(55) a. [[graad]$_{M1}$ Ask]$_{M2}$
b. [gradAsk]$_{M2 = Ft}$

This is shown in the tableau in (56). The wellformed candidate in (56a) violates Parse μ but complies with all the other relevant constraints. The other candidate forms either violate the size constraint, as (56b), or form less than optimal feet, as (56c) which violates TrochaicQuantity. FootBinarity is observed in all three candidate forms; the presence of tone in any of the candidates would only aggravate the situation, so this alternative is not considered here.

(56) [[luud]$_{M1}$ ost]$_{M2}$

	Trochaic Quantity	M2 = Ft	FootBinarity	Parse μ
» a. [(ludost)]$_{M2}$				*
b.[(luu)dost]$_{M2}$		* !		
c. [(luudost)]$_{M2}$	* !			

However, the forms in (51) - (52), which minimally differ from those in (47) - (48) in being endowed with a High tone, fail to comply with the size constraint on the M2 constituent:

(57) a. [[gluup]$_{M1}$ ost]$_{M2}$
H
b. [(gluu)(póst)]$_{M2}$ > Ft

(58) c. [[ruun]$_{M1}$ Ask]$_{M2}$
H
d. [(ruu)(nÁsk)]$_{M2}$ > Ft

Obviously, in this case, failure to parse a mora is not sufficient to reduce the M2 constituent to a single foot, as shown in (59).

(59) Violation of Parse μ
a. *[glu(póst)]$_{M2}$ > Ft
b. *[ru(nÁsk)]$_{M2}$ > Ft

This is due to the presence of a High tone on the M2 final syllable; this syllable is parsed as a foot, causing the entire M2 constituent to exceed the size of a foot. Failure to parse the High tone affiliated with the base would yield the desired result, as in (60), but is not an option here, which shows that M2 = Ft ranks higher than Parse μ, but lower than Parse H.

(60) Violations of Parse H and Parse μ
a. *[(glupost)]$_{M2}$ = Ft
b. *[(runAsk)]$_{M2}$ = Ft

This is summarized in the following tableau:

(61) [[gluup]$_{M1}$ ost]$_{M2}$
H

	Parse H	M2 = Ft	Parse μ
» a. [(gluu)(póst)]$_{M2}$		*	
b. [glu (póst)]$_{M2}$		*	* !
c. [(glu post)]$_{M2}$	* !		*

In (62) we inspect the set of illformed candidates that correspond to a single foot. They all satisfy M2 = Ft, but violate either TrochaicQuantity or ParseH or both. (It is not clear what the relative ranking of ParseH and TrochaicQuantity is, which leaves it undetermined which of the constraints rules out (62a).)

(62) [[gluup]$_{M1}$ ost]$_{M2}$
H

	Parse H	Trochaic Quantity	M2 = Ft	Parse μ
» a. [(gluu post)]$_{M2}$	* (!)	* (!)		
b. [(glu póst)]$_{M2}$		* !		*
c. [(glu post)]$_{M2}$	* !			*

In sum, these facts show that the optimal disyllabic foot corresponds to an even trochee; both heavy syllables and syllables with tone are excluded from this configuration. This follows from constraint rankings established here, and summarized in (63); I also assume that M2 = Ft is dominated by FootBinarity.

(63) Rankings:
a. M2 = Ft >> Parse μ
b. TrochaicQuantity >> M2 = Ft
c. ParseH >> M2 = Ft
d. FootBinarity >> M2 = Ft

It should also be noted that M2 = Ft ranks lower than ParseSegment, the requirement to parse segments into prosodic structure, as shown in the following tableau listing the candidate forms for (49c). Satisfying M2 = Ft leads to multiple parse violations: not only a mora, but also a segment remains unparsed, as in (64c), therefore the wellformed candidate form fails to comply with this constraint.

(64) [[opaak]$_{M1}$ ost]$_{M2}$
H

	ParseSeg	M2 = Ft	Parse μ
» a. [o (paa) kost]$_{M2}$		*	
b. [(opa) kost]$_{M2}$		*	* !
c. [(pakost)]$_{M2}$	* !		*

3.2 Prosodic minimality of words

The MW constituent corresponds to a prosodic word, as in (65), and due to the hierarchical organization of prosodic units, should minimally include a foot (McCarthy and Prince 1986, 1990, 1993a, and the references therein). It will be shown that the inventory of feet in (46), most importantly, the monosyllabic feet (46a) and (46d), set the lower bound for a possible prosodic word.

(65) MW = PrWd

We first look at the class of nouns. Toneless monosyllabic nominal bases exhibit the behavior typically associated with minimal word requirements. This is encountered in the nominative (with the inanimates, also the accusative) singular of two declension classes, the masculine and one of the feminine paradigms, both illustrated in (66). In both these classes, the nominative singular desinence corresponds to a yer vowel.

(66) Toneless monosyllables:
a. Masculine declension class:

Nom.Sg		Gen.Sg	Gloss
brood(A)	*brod(A)	broda	'boat'
boog(A)	*bog(A)	boga	'god'
goost(A)	*gost(A)	gosta	'guest'
tvoor(A)	*tvor(A)	tvora	'skunk'
taast(A)	*tast(A)	tasta	'father-in-law'
znooj(A)	*znoj(A)	znoja	'sweat'
raaj(A)	*raj(A)	raja	'paradise'
meed(A)	*med(A)	meda	'honey'
noos(A)	*nos(A)	nosa	'nose'
leed(A)	*led(A)	leda	'ice'
kraaj(A)	*kraj(A)	kraja	'end'
moost(A)	*most(A)	mosta	'bridge'
roog(A)	*rog(A)	roga	'horn'
rooj(A)	*roj(A)	roja	'swarm'
sooj(A)	*soj(A)	soja	'kind'
sook(A)	*sok(A)	soka	'juice'
rood(A)	*rod(A)	roda	'kin'

b. Feminine declension class:

Nom.Sg		Gen.Sg	Gloss
nooć(A)	*noć(A)	noći	'night'
krrv(A)	*krv(A)	krvi	'blood'
mooć(A)	*moć(A)	moći	'might'
peeć(A)	*peć(A)	peći	'stove'
žuuč(A)	*žuč(A)	žuči	'gall'
žeedj(A)	*žedj(A)	žedji	'thirst'
laaž(A)	*laž(A)	laži	'lie'
raaž(A)	*raž(A)	raži	'rye'
koost(A)	*kost(A)	kosti	'bone'

As noted in the previous section, we have to assume that yers are included in syllable structure at MLevel, as they can be associated with tone. We further assume that this segment is included into foot structure, in order to accommodate the facts in section 3.1. However, a yer remains unfooted if it appears final in a prosodic word, which results in the following representation:

(67) a. brod A — brood A

σ_μ <σ_μ> — [[$\sigma_{\mu\mu}$]$_{Ft}$ <σ_μ>]$_{PrWd}$

b. noć A — nooć A

σ_μ <σ_μ> — [[$\sigma_{\mu\mu}$]$_{Ft}$ <σ_μ>]$_{PrWd}$

Here, only the first syllable is parsed into foot structure. However, being toneless and monomoraic, this syllable will achieve the size of a foot by overparsing a mora, which is filled by lengthening the vowel of the base.

By contrast, monomoraic bases that possess lexical tone are not subject to vowel lengthening, as shown in (68):

(68) Monosyllables endowed with tone:

Nom.Sg		Gen.Sg	
rák(A)	*ráak(A)	ráka	'crab'
bég(A)	*béeg(A)	bégа	'bey'
brát(A)	*bráat(A)	bráta	'brother'
vírt(A)	*vírrt(A)	vírta	'garden'
grád(A)	*gráad(A)	gráda	'hail'
gráh(A)	*gráah(A)	gráha	'bean(s)'
déd(A)	*déed(A)	déda	'grandfather'
dlán(A)	*dláan(A)	dlána	'palm'
zét(A)	*zéet(A)	zéta	'brother-in-law'
klín(A)	*klíin(A)	klína	'nail'
kmét(A)	*kméet(A)	kméta	'serf'
lán(A)	*láan(A)	lána	'flax'

láv(A)	*láav(A)	láva	'lion'
lúk(A)	*lúuk(A)	lúka	'onion'
míš(A)	*míiš(A)	míša	'mouse'
mráz(A)	*mráaz(A)	mráza	'frost'
prág(A)	*práag(A)	prága	'threshold'
prst(A)	*prrst(A)	prsta	'finger'
sír(A)	*síir(A)	síra	'cheese'
hléb(A)	*hléeb(A)	hléba	'bread'
čás(A)	*čáas(A))	čása	'moment'
cár(A)	*cáar(A)	cára	'emperor'

The minimal contrast between the forms in (66) and (68) is that the latter contain a syllable associated with tone, which constitutes one of the licit foot types, as shown in (69).

(69) a. $[\ [\ \underset{H}{rak}\ ]_{M1}\ A\ ]_{MW}$

b. rák A

$[\ [\sigma\mu]_{\phi}\ <\sigma\mu>]_{PrWd}$

H

The forms in (67) thus comply with FootBinarity, while those in (69) comply with FootSalience. This complementarity crucially follows from the following ranking of these two foot related constraints:

(70) FootBinarity >> FootSalience

FootBinarity plays a crucial role in toneless forms, which satisfy the minimality requirement by overparsing a mora, that is, by inducing a violation of Fill (Prince and Smolensky 1993), a constraint that prohibits prosodic positions unassociated with segmental material. As shown in the tableau in (71), the wellformed candidate (71a) violates not only Fill but also FootSalience. However, candidates that do satisfy FootSalience, those in (71d) and (71e), are ruled out because they violate constraints on grouping, FootBinarity and TrochaicQuantity respectively. (The form in (71c) is not footed, therefore none of the foot related constraints can be violated in this case)[12].

12 FootBinarity could alternatively be satisfied by vocalizing the yer, so the issue arises what excludes this possibility. The parsing of word final syllables headed by a yer appears to be more costly than the overparse of a mora. In other words, Fill ranks lower than the constraint which prohibits yers in word-final footed syllables. At SLevel, this constraint is considerably strengthened: no syllables headed by yers are parsed into feet, regardless of their position within the word.

(71) [brod A]$_{MW}$

	MW = PrWd	Trochaic Quantity	FootBinarity	Fill	FootSalience
» a. [(brood) A]$_{MW}$				*	*
b. [(brod) A]$_{MW}$			* !		*
c. [brod A]$_{MW}$	* !				
d. [(bród) A]$_{MW}$			* !		
e. [(bróod) A]$_{MW}$		* !		*	

Forms with lexical tone are subject to ParseH, which outranks constraints on grouping and brings out the effect of FootSalience, as shown in (72). Crucially, (72c) which corresponds to a perfect trochaic foot is less optimal than (72a) because it violates ParseH.

(72) [rák A]$_{MW}$

	MW = PrWd	ParseH	FootBinarity	Fill	FootSalience
» a. [(rák) A]$_{MW}$			*		
b. [(rak) A]$_{MW}$.		* !	*		*
c. [(raak) A]$_{MW}$		* !		*	*

We now inspect candidates that satisfy FootSalience; (73a), which violates FootBinarity, fares better than (73a), which satisfies this constraint but violates TrochaicQuantity. These forms crucially show that TrochaicQuantity ranks higher than FootBinarity.

(73) [rák A]$_{MW}$

	MW = PrWd	Trochaic Quantity	FootBinarity	Fill
» a. [(rák) A]$_{MW}$			*	
b. [(ráak) A]$_{MW}$		* !		*

In (74) we summarize the rankings of constraints relevant for imposing the minimal word requirement, which amounts to a requirement on minimal footing.

(74) Rankings:

a. FootBinarity >> FootSalience

b. TrochaicQuantity >> FootSalience

c. TrochaicQuantity >> FootBinarity

d. ParseH >> FootBinarity

e. FootBinarity >> Fill

It is interesting to note that the two classes in (66), the subclass of the masculine declension in (66a), and one of the feminine declension classes in (66b), are both unproductive. As observed in Browne (1975), no new forms, either native or foreign, may be added to these classes. New monomoraic nouns are thus generally endowed with tone, and satisfy the minimality requirement without resorting to vowel lengthening[13].

In sum, this set of facts demonstrates the need to include the monomoraic syllable associated with tone among possible foot types[14]. Only by assuming that both a bimoraic toneless syllable and a monomoraic syllable associated with tone ((46a) and (46d) respectively) correspond to licit feet can we account in a consistent fashion for the facts pertaining to the minimal size of prosodic words.

The minimal size constraint takes effect in other word classes as well.[15] In the class of verbs, the minimality effect is demonstrated by the aorist paradigm, which includes some clearly toneless members. According to Belić (1973:105-110), there are two aorist subparadigms, illustrated in (75a) and (75b) (the examples are taken from Daničić 1925, Leskien 1914:546, and Belić 1973):

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[13] In addition, there is also a third type of case, instantiated by the class of stems with tone invariably residing on the desinence, as in *póp* (NomSg) / *popá* (GenSg) 'priest', which meet the minimality requirement due to the presence of tone. In the nominative singular form tone retracts from the yer desinence, and is realized on the base. (Following the terminology in Illich-Svitych 1979, this is the oxytone accentual class; the toneless forms in (67) belong to the mobile class, and those in (69), with tone on the stem, to the barytone class.) Note that tone on the desinence in the oxytone class is not predicted under the tonal constraints posited in section 2. A special proviso is needed for this class, to the effect that tone may not be associated with the root.

[14] These facts have been interpreted in the literature (Garde 1976:248; Belić1956:166-7; Leskien 1914:128-129) as compensatory lengthening in the nominative singular triggered by the loss of the yer vowel. However, these sources also point out that no lengthening is evidenced in accented forms. The advantage of the present account is that it treats the interactions of accent and length as part of the same general phenomenon.

[15] The minimality effect is encountered in only one monomoraic adjectival form: *boos* vs. *bosa* 'barefooted'.

(75) Aorist verbal forms:

	1Sg	2/3Sg	1Pl		
a.	bíh	bii	bísmo	'be'	(bi-)
	zváh	zvaa	zvásmo	'call'	(zva-)
	píh	pii	písmo	'drink'	(pi-)
	líh	lii	lísmo	'pour'	(li-)
	1Sg	2/3Sg	1Pl		
b.	čúh	čú	čúsmo	'be'	(ču-)
	kríh	krí	krísmo	'hide'	(kri-)
	bíh	bí	bísmo	'beat'	(bi-)
	sláh	slá	slásmo	'send'	(sla-)

The verbs in (75a) and (75b) all have monosyllabic forms in the first and second/third person singular. Crucial here are the 2/3Sg forms, which are (morphologically) toneless in (75a) but endowed with tone in (75b). This correlates with the corresponding prosodic size: the 2/3Sg forms are bimoraic in (75a), and monomoraic in (75b), although the roots are monomoraic in both cases[16]. Again, we see that a toneless monosyllabic form has to be bimoraic in order to meet the minimal size requirement, while forms with their own tone may be monomoraic, and still meet this requirement.

3.3 Size constraint on the masculine nominal declension class

This size constraint, which affects one of the four nominal declension classes, provides further evidence for the ranking of foot-related constraints established in (74), as well as their status with respect to ParseH. Again, toneless forms are footed in accordance with FootBinarity, and forms with lexical tone observe FootSalience.

The suffix *-ov* serves as an augment for bases belonging to the masculine declension, and appears in the plural forms of those members of the class that are at most two moras in size[17]. As shown in (76), bases consisting of one or two moras, those in (76a) - (76c), are augmented in their plural forms, while those that exceed two moras, as in (76d), are not.

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16 The tonal patterns in (75) are further corroborated by the SLevel tone/stress on the corresponding prefixed forms: the prefixed version of (75a), *pózvaa*, with both stress and tone on the initial syllable, behaves like a typical toneless form, while the prefixed version of (75b), *pókrí*, with tone over two syllables and initial stress, patterns with forms lexically endowed with tone.

17 This suffix has two shapes, *-ev* after a palatal consonant, and *-ov* elsewhere. A few forms, such as *put* and *nos* exceptionally take *-ev*.

(76) Masculine declension class:

a. rak- 'crab'
Singular: rak, raka, raku, etc.
Plural: rakovi, rakova, rakovima, etc.

b. kraalj- 'king'
Singular: kraalj kraalja, kraalju etc.
Plural: kraaljevi, kraaljeva, kraaljevima

c. vitez- 'knight'
Singular: vitez, viteza, vitezu
Plural: vitezovi, vitezova, vitezovima etc.

d. manastir- 'monastery'
Singular: manastir, manastira, manastiru
Plural: manastiri (*manastirovi), etc.

Bases belonging to the other three declension classes are not augmented in this fashion regardless of their size.

This augment thus serves a morphological as well as a prosodic function. The facts in (76) strongly suggest that the plural bases of the masculine declension class are subject to a prosodic size constraint, and that the *-ov* augment, which subcategorizes solely for this declension class, is directly linked with this constraint.

(77) ov [[ ]$_{N,masc}$ __]$_{N,masc/pl}$

It still remains to be seen what is the exact nature of this size constraint. Given that monomoraic, as well as bimoraic, forms are augmented, I will argue that the prosodic requirement on the plural bases belonging to the masculine declension is that they ought to be greater than a foot, as stated in (78):

(78) $\underline{\text{Base}_{\text{MascPl}}} > \underline{\text{Ft}}$

Bases whose size does not exceed a foot satisfy this constraint by resorting to *-ov* suffixation. Augmented forms are parsed into a foot plus some additional material, at least an unfooted syllable and at most another foot; augmentation has to be minimal, as will be seen below.

While it is obvious that a bimoraic base may easily be augmented to a size greater than a foot by combining with *-ov*, it is less obvious how such a result could be achieved in the case of monomoraic bases. This result is indeed achieved, but the actual facts are fairly complex, and tone plays quite an important role. On closer inspection, we can discern two distinct tonal patterns associated with the augment *-ov*, and due to this, are

compelled to posit two distinct allomorphs, one added primarily to monomoraic forms, the other mostly to bimoraic forms. The former is associated with tone and is a M1 suffix, the latter is a toneless M2 suffix.

(79) a. Allomorph1 (added to monomoraic bases): ov $]_{M1}$ (H)

b. Allomorph2 (added to bimoraic bases): ov $]_{M2}$

We now focus on how the two allomorphs operate, starting with the toneless one, Allomorph2, which selects bimoraic bases. We will first inspect the toneless bases: this allomorph combines with those corresponding to a single heavy syllable, as in (80), or two light syllables, as in (81)[18].

(80) Bimoraic forms: $\sigma_{\mu\mu}$, toneless

	Base		NomPl	
a.	graad-	graadov-	gradovi	'city'
b.	suud-	suudov-	sudovi	'court'
c	sveet-	sveetov-	svetovi	'world'
d.	cveet-	cveetov-	cvetovi	'flower'
e.	glaas-	glaasov-	glasovi	'voice'
f.	druug-	druugov-	drugovi	'friend'
g.	daar-	daarov-	darovi	'gift'
h.	ziid-	ziidov-	zidovi	'wall'
i.	kluub-	kluubov-	klubovi	'club'

(81) Bimoraic forms: $\sigma_{\mu}\sigma_{\mu}$, toneless

	Base		NomPl	
a.	labud-	labudov-	labudovi	'swan'
b.	čopor-	čoporov-	čoporovi	'pack'
c.	jablan-	jablanov-	jablanovi	'poplar'
d.	limun-	limunov-	limunovi	'lemon'
e.	kesten-	kestenov-	kestenovi	'chestnut-tree'
f.	slučaj-	slučajev-	slučajevi	'case, accident'
g.	vitez-	vitezov-	vitezovi	'knight'

These cases are straightforward. In each, the base corresponds to a single trochaic foot and is minimally augmented, as shown in (82):

(82) a. [graad-] $_{Bmasc}$ Bmasc = Ft [(graad)ov-] $_{Bmasc/pl}$ Bmasc/pl > Ft

b. [labud-] $_{Bmasc}$ Bmasc = Ft [(labu)dov-] $_{Bmasc/pl}$ Bmasc/pl > Ft

[18] Note that, in (80), the long vowel of the root is shortened in the output form. This is due to the effect of the size constraint on the M2 constituent (cf. section 3.1), and is dealt with in section 3.4.

Bases as in (83) and (84), which are disyllabic but contain more than two moras, may not be augmented in this fashion, for the obvious reason.

(83) Disyllabic forms ($\sigma_{\mu\mu}\sigma_{\mu}$, toneless):

	Base		NomPl	
a.	dooboš-	*doobošov-	dooboši	'drum'
b.	loogor-	*loogorov-	loogori	'camp'
c.	aandjel-	*aandjelov-	aandjeli	'angel'
d.	maajstor-	*maajstorov-	maajstori	'artisan'
e.	kiicoš-	*kiicošov-	kiicoši	'dandy'
f.	praaznik-	*praaznikov-	praaznici	'holiday'

(84) Disyllabic forms ($\sigma_{\mu}\sigma_{\mu\mu}$, toneless):

	Base		NomPl	
a.	dinaar-	*dinaarov-	dinaari	'dinar(currency)'
b.	komaad-	*komaadov-	komaadi	'piece
c.	meseec-	*meseecov-	meseeci	'month, moon'
d.	miriis-	*miriisov-	miriisi	'fragrance'
e.	oblaak-	*oblaakov-	oblaaci	'cloud'
f.	obliik-	*obliikov-	obliici	'shape'
g.	pehaar-	*pehaarov-	pehaari	'chalice'

These bases already exceed the size of a foot, and thus meet the prosodic requirement in (85):

(85)

a.	[dooboš-]$_{\text{Bmasc}}$	Bmasc > Ft	[(doo)boš-]$_{\text{Bmasc/pl}}$	Bmasc/pl > Ft
b.	[dinaar-]$_{\text{Bmasc}}$	Bmasc > Ft	[di(naar)-]$_{\text{Bmasc/pl}}$	Bmasc/pl > Ft

We now turn to bases with their own High tone, which bring in the set of tonal feet. As shown in (86), Allomorph2 may combine with monosyllabic (bimoraic) forms affiliated with a High:

(86) Bimoraic forms ($\sigma_{\mu\mu}$, affiliated with lexical tone):

	Base		NomPl	
a.	kraalj-	kraaljév-	kraaljévi	'king'
b.	leek-	leekóv-	leekóvi	'medicine'
c.	noož-	noožév-	noožévi	'knife'
d.	puut-	puutév-	puutévi	'road'
e.	paanj-	paanjév-	paanjévi	'log'
f.	miir-	miiróv-	miiróvi	'peace'

Allomorph2 behaves like a typical M2 toneless suffix: it is toneless when combined with a toneless root, as in (80) - (81), and is linked to a High when combined with a root that has its own tone but cannot serve as its target, as in (86). This is represented explicitly in (87a) and (87b) respectively:

(87) a. Allomorph2 added to a toneless base: [[graad]$_{M1}$ ov]$_{M2}$ graadov-

b. Allomorph2 added to a base with a High: [[kraalj]$_{M1}$ ov]$_{M2}$ kraaljév-
H

In both cases the base itself, being bimoraic, corresponds to a foot, and therefore has to be augmented. Tonal interactions are observed, of course, only in (87b): the floating High docks on the suffix (due to Tone-to-Foot Alignment, since the M1 final mora is not the head of a foot), so that the result of augmentation is two feet, one corresponding to a bimoraic syllable, the other to a monomoraic syllable associated with tone.

(88) a. [kraalj-]$_{Bmasc}$ Bmasc = Ft [(kraa)(ljév)-]$_{Bmasc/pl}$ Bmasc/pl > Ft

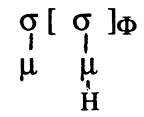
However, disyllabic bimoraic forms affiliated with a High tone fail to combine with this augment:

(89) Bimoraic forms: $\sigma_\mu\sigma_\mu$, affiliated with tone

	Base		NomPl	
a.	jelén-	*jelénov-	jeléni	'deer'
b.	bisér-	*bisérov-	biséri	'pearl'
c.	bubrég-	*bubrégov-	bubrézi	'kidney'
d.	guštér-	*guštérov-	guštéri	'lizard'
e.	bedém-	*bedémov-	bedémi	'fortification'
f.	krevét-	*krevétov-	krevéti	'bed'
g.	medvéd-	*medvédov-	medvédi	'bear'
h.	nevén-	*nevénov-	nevéni	'marigold'
i.	oklóp-	*oklópov-	oklópi	'armor'
j.	potók-	*potókov-	potóci	'brook'
k.	unúk-	*unúkov-	unúci	'grandson'

In this case, the lexical High docks on the final mora of the base, and as a result, the second syllable alone forms a single foot (of the (46d) type) due to its tonal association, as shown in (90):

(90) a. j e l e n



b. [jelén-]$_{Bmasc}$ Bmasc > Ft [je(lén)-]$_{Bmasc/pl}$ Bmasc/pl > Ft

The base, and therefore its plural counterpart as well, is greater than a foot, therefore there is no need for augmentation.

It is worth pointing out that the bases in (89) are bimoraic, just like those in (81), the only difference being that the former, but not the latter, are affiliated with tone. This minimal difference, however, is sufficient to produce a difference in foot structure, which in turn leads to different behaviors with respect to *-ov* augmentation.

The other allomorph, Allomorph1 (listed in (79a)), a M1 suffix affiliated with tone, is added to monomoraic roots. Note that all monomoraic roots are augmented, both toneless, as in (91), and those with their own tone, as in (92)[19].

(91) Monomoraic forms: σ_{μ}, toneless

	Base		NomPl	
a.	rod-	rodóv-	rodóvi	'kin'
b.	bog-	bogóv-	bogóvi	'god'
c.	brod-	brodóv-	brodóvi	'boat'
d.	raj-	rajév-	rajévi	'paradise'
e.	nos-	nosév-	nosévi	'nose'
f.	most-	mostóv-	mostóvi	'bridge'
g.	sok-	sokóv-	sokóvi	'juice'

(92) Monomoraic forms: σ_{μ}, affiliated with High

	Base		NomPl	
a.	rak-	rakóv-	rakóvi	'crab'
b.	vrt-	vrtóv-	vrtóvi	'garden'
c.	dlan-	dlanóv-	dlanóvi	'palm'
d.	zet-	zetóv-	zetóvi	'brother-in-law'
e.	kmet-	kmetóv-	kmetóvi	'serf'
f.	lav-	lavóv-	lavóvi	'lion'
g.	miš-	mišév-	mišévi	'mouse'
h.	prag-	pragóv-	pragóvi	'threshold'
i.	čas-	časóv-	časóvi	'moment'

The augment *-ov* is associated with a High tone in monomoraic augmented forms regardless of whether the base it combines with is toneless, or endowed with a High. As argued in the previous section, this type of pattern is associated with M1 suffixes affiliated with tone. The relevant cases are given in (93):

(93) a. Allomorph1 added to a root with a High: [rat + ov]$_{M1}$ (H H) ratóv-

b. Allomorph1 added to a toneless root: [rod + ov]$_{M1}$ (H) rodóv-

[19] The same type of behavior is exhibited by monomoraic forms belonging to the oxytone accentual class (see note 13), exemplified by *póp/popá/popóvi* 'priest'. These roots possess their own tone, which is invariably realized on a suffix.

The fact that Allomorph1 rather than Allomorph2 combines with monomoraic toneless roots (listed in (91), can be explained in prosodic terms. Since a monomoraic base is prosodically less than a foot, its combination with the toneless Allomorph2 would result in a form whose size is exactly a foot:

(94) Allomorph2: [rod-] $_{Bmasc}$ Bmasc < Ft *[(rodov)-] $_{Bmasc/pl}$ Bmasc/pl = Ft

*[[rod]$_{M1}$ ov]$_{M2}$

Combined with Allomorph1, which is affiliated with tone, this type of base yields the right result, as shown in (95). The size of the resulting form is greater than a foot, since the second syllable, which carries tone, corresponds to a foot in its own right.

(95) Allomorph1: [rod-] $_{Bmasc}$ Bmasc < Ft [ro(dóv)-] $_{Bmasc/pl}$ Bmasc/pl > Ft

[[rod]$_{M1}$ ov]$_{M1}$
H

Monomoraic bases with their own Highs, those in (92), also combine with Allomorph1, or at least most of them do, although the prosodic motivation for this is not as urgent as with toneless monomoraic bases. Whichever of the allomorphs they combine with, monomoraic roots with their own Highs result in a base whose size exceeds that of a foot. In both (96a) and (96b) tone has to be parsed within the M1 constituent, which accounts for the difference in docking sites.

(96) a. Allomorph 1:
[rak-] $_{Bmasc}$ Bmasc < Ft [rakóv-] $_{Bmasc/pl}$ Bmasc/pl > Ft

[[rak]$_{M1}$ ov]$_{M1}$
H H

b. Allomorph 2:
[rák-] $_{Bmasc}$ Bmasc = Ft *[rákov-] $_{Bmasc/pl}$ Bmasc/pl > Ft

*[[rak]$_{M1}$ ov]$_{M2}$
H

Thus, the choice of Allomorph1 rather than Allomorph2 appears to be arbitrary in this case. It is interesting to note that monomoraic bases with their own Highs fall into two subclasses, those that select Allomorph1 and those that select Allomorph2. The forms in (97) combine with Allomorph2, following the pattern in (96b), as detailed in (98):

(97) déd- dédov- 'grandfather'
cár- cárev- 'emperor'
bég- bégov- 'bey'

(98) a. Allomorph 1:
[ded-] Bmasc Bmasc < Ft *[dedóv-] Bmasc/pl Bmasc/pl > Ft

*[[ded]M1 ov]M1
H H

b. Allomorph 2:
[déd-] Bmasc Bmasc = Ft [dédov-] Bmasc/pl Bmasc/pl > Ft

[[ded]M1 ov]M2
H

The split among the forms of this root shape may well be attributed to the fact that there is no prosodic advantage in choosing one allomorph over the other. This arbitrariness of choice then leads to a lexicalized preference for one of the allomorphs.

It must be obvious by now why it is that bimoraic forms combine with Allomorph2 rather than Allomorph1. While Allomorph2 adds just one mora to the form which corresponds exactly to a foot, as in (99b), Allomorph1 would also bring in a High tone, which would result in a prosodically weightier form --- with two feet , as in (99a)[20].

(99) a. Allomorph 1:
[graad] Bmasc *[(graa)(dóv)] Bmasc/pl Bmasc = Ft Bmasc/pl >Ft (2Ft)
*[[graad]M1 ov]M1
H

[labud] Bmasc *[(labu)(dóv)] Bmasc/pl Bmasc = Ft Bmasc/pl >Ft (2Ft)
*[[labud]M1 ov]M1
H

b. Allomorph 2:
[graad] Bmasc [(graa)dov] Bmasc/pl Bmasc = Ft Bmasc/pl >Ft (1Ft+1σ)
[[graad]M1 ov]M2

[labud] Bmasc [(labu)dov] Bmasc/pl Bmasc = Ft Bmasc/pl >Ft (1Ft+1σ)
[[labud]M1 ov]M2

[20] However, most loan words in this class combine with Allomorph1, following the pattern in (89a), e.g., *joonóvi (joon-)* 'ion', *miitóvi (miit-)* 'myth', *baaróvi (baar-)* 'bar', *plaanóvi (plaan-)* 'plan'; this behavior can be accounted for as a strategy to avoid vowel shortening, which would necessarily result if the form combined with Allomorph2 (compare (80) above). As observed in note 10, the requirement to parse a mora is imposed more strictly in loan words. Several native words depart from the general pattern, as well. Certain monosyllabic forms belonging to this class may combine with either Allomorph1 or Allomorph2, as evidenced by doublets in the plural: *radovi/raadóvi (raad-)* 'work'; *vozovi/voozóvi (vooz-)* 'train'. There are also a few native forms that take only Allomorph1: *kriinóvi (kriin-)* 'lily', *booróvi (boor-)* 'pinetree'.

Thus, the form created by Allomorph1 would be greater in size than the form created by Allomorph2; because augmentation has to be minimal, Allomorph2 is the preferred choice[21].

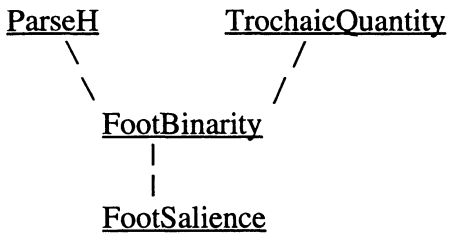
To conclude, with both allomorphs the result of augmentation is greater than a foot, and in both cases augmentation is minimal. The choice of the allomorph is prosodically governed, thus it is no accident that Allomorph1 combines with monomoraic, and Allomorph2 with bimoraic roots (cf. Mester's 1994 analysis of prosodically motivated allomorphy in Latin).

3.4 Constraint interactions and ranking

In this section, I have provided evidence for three size constraints operating in NS. The size constraints that have been proposed here all fall under the rubric of alignment between morphological and prosodic categories. However, rather than pointing at a general strategy that sets the shapes of morphological elements, they appear to impose minimal degrees of footing. It may well be that principles of exhaustive footing are operative only at SLevel; all that seems to be required at MLevel is the minimal presence of at least some foot structure.

Crucial for our purposes is the fact that these size constraints call for the foot inventory in (46), which includes both standard trochaic feet, and the somewhat peculiar set of tonal feet, providing evidence for the following ranking of constraints governing foot shapes (extrapolated from (63) and (74) above):

(100) Ranking of constraints governing foot shapes:



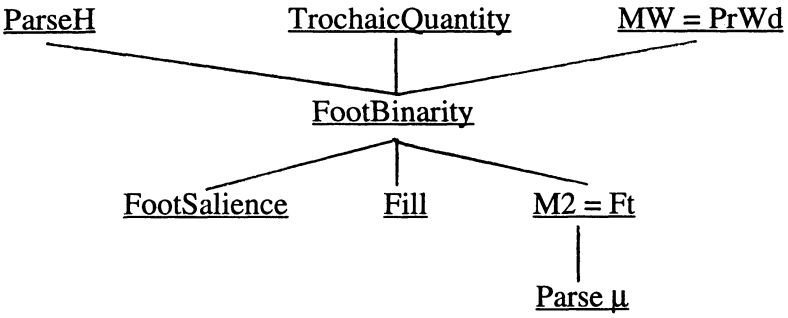
[21] Bimoraic forms with their own Highs, listed in (86), yield exactly the same result, whichever allomorph they combine with. Here I have assumed, for convenience, that they combine with Allomorph2, but it may well be that the choice is in fact arbitrary.

In the next section, we turn to the stress system, to be captured in terms of this same foot inventory, but with different preferences for foot types, due to a difference in constraint interactions.

*
* *

A note is in order regarding the ranking of the size constraints proposed in this section. While the minimal word constraint is undominated, the other two constraints may be violated. This has already been documented for M2 = Ft, a size constraint dominated by several constraints, as stated in (63) above. In (101) is given the place of these two size constraints within the overall ranking of constraints proposed in this section (corresponding to (63) and (74) above):

(101)



Although dominated, M2 = Ft may override the effect of $\text{Base}_{\text{Masc/Pl}} \geq \text{Ft}$, which sets the lower bound on forms in the masculine declension class. In other words, these two constraints are ranked as follows:

(102) $\text{M2} = \Phi \gg \text{Base}_{\text{Masc/Pl}} \geq \text{Ft}$

This is documented by the members of the masculine declension class augmented by *-ov* listed in (80), that is, those that are toneless and combine with Allomorph2. A form from this class is listed again in (91):

(103) [graad] $_{\text{Bmasc}}$ [(graa)dov] $_{\text{Bmasc/pl}}$ Bmasc = Ft Bmasc/pl >Ft (1ϕ+1σ)

Since Allomorph2 is a M2 suffix, it brings in the size constraint on the M2 morphological constituent, causing the shortening of the root vowel, as shown in (104):

(104) a. [[graad]$_{M1}$ ov]$_{M2}$
b. *[graadov]$_{M2 > Ft}$
c. [gradov]$_{M2 = Ft}$

By satisfying $\underline{M2 = \Phi}$, (92c) violates $\underline{Base_{Masc/Pl} > \Phi}$, since now its size no longer exceeds a foot. Although the two constraints operate on orthogonal morphological constituents, they are obviously ranked, since the wellformed output form satisfies only one of them, as shown in (105):

(105)

	M2 = Ft	$B_{Masc/Pl} > Ft$	Parse μ
» a. [(gradov)]$_{BMasc/Pl-M2}$		*	*
b. [(graa) dov]$_{BMasc/Pl-M2}$	* !		

However, the size of the wellformed (104c) does not in fact differ from the size of the unaugmented plural base:

(106) [graad] $_{Bmasc}$ *[(graad)] $_{Bmasc/pl}$ Bmasc/pl = Ft

Both (104c) and (106) correspond exactly to a foot, the only difference being that the former is disyllabic, and the latter, monosyllabic. This correlates with a fact regarding *-ov* augmentation which has not yet been mentioned: while monosyllabic bases are obligatorily augmented in this fashion, a number of disyllabic bases may escape augmentation, which suggests the relevance of the following constraint:[22]

(107) $Base_{Masc/Pl} \geq \sigma\sigma$

This constraint is responsible for eliminating the form in (106), as shown in the tableau in (108):

22 While the augmentation of monosyllabic forms is fully productive, with only a small number of exceptions (*prst, zuub, djaak, konj*), the augmentation of disyllabic forms is no longer productive.

(108)

	$B_{Masc/Pl} \geq$ σσ	M2 = Ft	$B_{Masc/Pl} >$ Ft	Parse μ
» a. [(gradov)]$_{BMasc/Pl-M2}$			*	*
b. [(graa) dov]$_{BMasc/Pl-M2}$		* !		
c. [(graad)] $_{BMasc/Pl-M1}$	* !		*	

4. Stress and its interactions with tone

The NS stress pattern departs from typical stress patterns, due to the fact that the stressed syllable is necessarily associated with a High tone. Moreover, although foot structure is present at both MLevel and SLevel, stress is a SLevel phenomenon.

At MLevel tone is found only in forms that possess at least one lexical High, while at SLevel, due to the co-presence of tone and stress, tone is required across the board, both in forms with lexical tone and those that are lexically toneless. The observed patterns are illustrated in (109) and (110) (with the stressed syllable underlined):

(109) Forms without lexical High

	MLevel	SLevel	Gloss
a.	graad	gráad	'city'
b.	dooboš	dóoboš	'drum'
c.	meseec	méseec	'moon'

(110) Forms with lexical High

	MLevel	SLevel	Gloss
a.	kúća	kúća	'house'
b.	malína	málína	'raspberry'
c.	tiranija	tiránija	'tyranny'
d.	protagonist	protagónist	'protagonist'

The distinction between toneless forms and those lexically endowed with tone is thus neutralized at SLevel. However, these two sets of forms exhibit distinct stress patterns. In lexically toneless words, stress accompanied by a High tone is found on the word-initial syllable, as in (109). In words that possess lexical tone, those in (110), the lexical High is linked both to the mora that serves as its original docking site, and to the immediately preceding one. The inevitable co-presence of tone and stress in many ways determines the locus of stress itself. While the forms in (109) have stress on the initial syllable, those in (110) appear to adjust the position of stress to the position of lexical tone. (Note that there are no secondary stresses in NS.)

But although lexical tone is obviously playing an important role in determining the place of stress, two facts strongly suggest that the distribution of stress cannot be reduced to the distribution of tone[23]. First, as we saw in section 2, High tones exhibit the tendency to dock as close to the word's right edge as possible. In this, the tonal system differs conspicuously from stress, which tends towards the word's left edge, as shown by both classes of cases in (109)-(110). Second, vowel length is lost in syllables preceding the stressed one, as illustrated in (111)[24]:

(111) a.	majstóríja / *maajstóríja	'craftsmanship'	(cf.maajstor 'craftsman')
b.	dobošaárá / *doobošaárá	'drummer(Gen,Sg)'	(cf. dooboš 'drum')

This fact, which figures regularly in the traditional descriptions of NS pitch-accent[25], provides crucial evidence for elucidating the phonological nature of stress. The prohibition against long vowels in pre-stress position will be interpreted as a phenomenon related to foot structure but, for obvious reasons, unrelated to tone. This, in turn, strongly suggests that both tone and foot structure are relevant in determining the locus of stress. The general picture that emerges is that of two independent systems exhibiting opposing tendencies, which are reconciled by prioritizing some of the tendencies at the expense of others.

4.1 The locus of stress

The specific goal at this point is to determine the locus of the stress-bearing foot, the designated foot in a prosodic word. With this in mind, we first turn to the forms in (109), those that possess no lexical tone. These forms reveal two relevant facts about the stress-bearing foot. First, it is the leftmost foot in the prosodic word; second, it is rendered salient by virtue of tonal association.

The leftmost position of the stress-bearing foot is easily captured by aligning this foot (here, the head of the prosodic word, $\text{Head}_{\text{PrWd}}$) with the left edge of the prosodic word, in the spirit of McCarthy and Prince's Generalized Alignment theory:

---

[23] In this I depart from the analysis in Inkelas and Zec (1988), where it is proposed that the distribution of stress follows the distribution of tone.

[24] The forms in (111) both consist of toneless bases combined with suffixes endowed with Highs (the M1 suffix *-ij* and the M2 suffix *-aar*).

[25] Consider the following quote from Leskien (1911:372): "Der enge Zusammengang der Lage des Hochtones mit den Quantitätsverhältnissen des Wortes zeigt sich for allem in der Hauptregel, dass vor der Hochtonsilbe keine Silbe lang sein kann, Längen also nur in oder nach der Hochtonsilbe ercheinen können."

(112) Align SFoot: Align (PrWd, L, $\text{Head}_{\text{PrWd}}$, L)

Next, the stress-bearing foot is necessarily associated with a High tone, which calls for the following constraint:

(113) SFootSalience: $\text{Head}_{\text{PrWd}}$ has to be associated with a High tone.

The High on the forms in (109) is in fact a byproduct of the requirement imposed by SFootSalience. This constraint is thus responsible for the overparse of tone in what would otherwise be toneless forms.

Because of the complex nature of the NS stress system, the present account invokes constraints on tone as well as those on foot structure, and will crucially depend on the ways these two sets of constraints interact with each other. Tone-related constraints are those we saw in section 2, repeated in (114a-c), together with an additional constraint, stated in (114d), which prohibits Highs linked to more than two moras.

(114) a. ParseH (TBU = mora)

b. OCP: *[. . .]Word
H H

c. Tone-to-Foot Alignment: * [σ]Φ
$\mu_s\mu_w$
H

d. HLink: A High may not be linked to more than two moras.

The relevance of the foot inventory (46) for prosodic morphology has already been demonstrated in section 3. This same foot inventory is responsible for determining the locus of stress. At SLevel, however, the optimal foot types are tonal feet, listed in (46c) and (46d) and repeated below[26]:

(115) a. [$\sigma_{\mu\mu}$]Φ
H

b. [σ_{μ}]Φ
H

26 Bethin (1993) also proposes to analyze the NS stress system in metrical terms. However, the foot inventory assumed in her work includes uneven trochees, which are here excluded from the set of possible foot types in NS.

This is due to SFootSalience, which is an undominated constraint, and as such neutralizes the distinction between forms that possess lexical tone and those that do not.

In the tableaux (116)-(118) we see the functioning of the stress-related constraints, including Tone-to-Foot. Only those forms that satisfy all three constraints are wellformed; in all other cases, the output form violates at least one constraint. Thus, failing on one count is sufficient to make a lexically toneless form ungrammatical. (In the tableaux below, foot structure is indicated by parentheses.)

(116) Input: (graad)

	SFootSalience	AlignSFoot	Tone-to-Foot
» a. (gráad)			
b. (graád)			*
c. graad		*	
d. (graad)	*		

(117) Input: (doo)boš

	SFootSalience	AlignSFoot	Tone-to-Foot
» a. (dóo) boš			
b. (doó) boš			*
c. (doo) (bóš)		*	
d. (doo) boš	*		

(118) Input: me(seec)

	SFootSalience	AlignSFoot	Tone-to-Foot
» a. (mé) (seec)			
b. me (séec)		*	
c. me (seéc)		*	*
d. (me) (seec)	*		
e. me (seec)	*	*	

The situation with lexically toneless forms is fairly simple, since in this case the stress-related constraints do not exhibit any significant interactions either with each other, or with any of the other constraints in the system. Note though that the two constraints on grouping, FootBinarity and TrochaicQuantity, need not be observed by the stress-bearing

foot: the former is violated in (118a), and the latter in (116a) and (118a), yet all these are wellformed candidates. This clearly indicates that, in the case of the stress-bearing foot, prominence overrides grouping: SFootSalience, which is itself undomianted, dominates both TrochaicQuantity and FootBinarity, and as a result, these two constraints have no effect on the shape of the stress-bearing foot.

Forms that possess lexical Highs introduce intricacies of their own. Lexical tone brings into the picture the set of tone-related constraints, which preclude free overparse of tone and therefore influence considerably the locus of the stress-bearing foot. To illustrate this, we take the noun in (110c), whose lexical High is parsed on the final syllable of the base, immediately preceding the inflectional suffix. The morphological constituency of this form, as well as the locus of the parsed High, is shown in (119).

(119) [[tiraníj]$_{M1}$ a]$_{MW}$ 'tyranny'

Here, stress may not occur on the initial syllable, as it does in lexically toneless forms. This is due to the OCP constraint: the High on the word-initial syllable of (120), which is a result of overparse, creates an OCP violation, although this form fully adheres to both SFootProminence and AlignSFoot.

(120) *(tí) ra (ní) ja

The output form in (121) is also illformed, this time due to ParseH, since the High with which this form is lexically affiliated has not been parsed (and it can only be parsed in compliance with the morphological constraints on tone, i.e. at the right edge of the M1 constituent, see section 2).

(121) *(tí) ranija

And, the output form in (122), although satisfying AlignSFoot, violates SFootSalience, since the initial syllable is not associated with tone.

(122) *(ti ra) (ní) ja

Thus, constraints on tone prevent the alignment of the stress-bearing foot with the absolute left edge of the prosodic word. Given this, it may appear that the optimal output form would be the one with the stress-bearing foot located on the syllable linked to the lexical High. As a consequence, the stress-bearing foot is two syllables away from the left

edge of the prosodic word, in violation of the constraint on initial alignment, but it satisfies all tone-related constraints.

(123) *tira(ní)ja
H

Yet, this form is not the correct output either. The relevant constraint at this point is HLink in (114d). While prohibiting Highs linked to more than two moras, this constraint permits Highs with fewer than three links, including the wellformed output form in (124), in which the High "stretches" one mora to the left.

(124) ti (rá) (ní) ja
\ /
H

The High in this form is doubly linked, and thus escapes the effect of the OCP constraint. Both (123) and (124) conform to HLink, but (123) violates AlignSFoot more drastically than the wellformed (124), which in its turn satisfies all tonal constraints but minimally violates AlignSFoot[27].

The form with a triply linked High, as in (125), would is banned by HLink although it fares better than either (123) or (124) with respect to AlignSFoot.

(125) * (tí)(rá)(ní)ja
\ | /
H

These interactions are summarized in the following tableau:

[27] Note that toneless forms include an additional candidate which satisfies the constraints proposed here, yet needs to be eliminated. For example, taking the form evaluated in (118), an additional candidate, **méséec*, with the High gratuitously spread to the right, satisfies all the relevant constraints, just like the wellformed *méseec* in (118a), and is crucially licensed by HLink. This form can be excluded by appealing to a constraint such as Structure, which requires that structure be constructed minimally (Prince and Smolensky 1993:25 and the references therein); **méséec* would violate Structure because its High is associated with two links, while the wellformed candidate possesses a singly linked High. In forms endowed with tone, AlignSFoot would override Structure. Another option is to introduce an additional, low ranking constraint, which requires that Highs be singly linked, and is violated under the pressure of AlignSFoot. Rightward spreading in toneless forms would then violate the constraint on singly linked Highs, without a concomitant satisfaction of a higher ranking constraint.

(126) Input: tira(ní)ja

	OCP	HLink	ParseH	SFootSalience	AlignSFoot
» a. ti (rá) (ní) ja					*
b. tira (ní) ja					* * !
c. (ti ra) (ní) ja				* !	
d. (tí) ranija			* !		
e. (tí) (rá) (ní) ja		* !			
f. (tí) ra (ní) ja	* !				

AlignSFoot is thus the only constraint that may be violated in this set of candidate forms. The four tonal constraints that preclude the alignment of the stress-bearing foot with the left edge of the prosodic word are all undominated, and therefore do not interact with each other.

The forms in (110a)-(110b), repeated in (127), have lexical tone closer to the word's left edge, and therefore both fully comply with AlignSFoot.

(127) a. (kú) ća [MLevel: (kú) ća]
b. (má) (lí) na [MLevel: ma (lí) na]

In (127a), the lexical High is parsed on the word-initial syllable (which is also final in M1), so that the requirements placed by AlignSFoot and SFootSalience are fully compatible. The form in (127b) has lexical tone on the word's second syllable, which again allows for the perfect alignment of the stress-bearing foot with the prosodic word's left edge, without violating any of the tone-related constraints. As shown in (128), all candidates observe SFootSalience (which is therefore omitted from the tableau), and each of the illformed candidates violates one of the tone-related constraints; the violations in (128d) and (128e) are somewhat gratuitous.

(128) Input: (má) (lí) na

	OCP	HLink	ParseH	AlignSFoot
» a. (má) (lí) na H				
b. ma (lí) na H				* !
c. (má) li na H			* !	
d. (má) (lí) (ná) H		* !		
e. (má) (lí) na H H	* !			

Note that the Tone-to-Foot constraint may be violated in order to satisfy a more highly ranked constraint, as in (129). The optimal output form, which violates Tone-to-Foot, has stress on the second syllable, with a minimal violation of AlignSFoot and no violation of the other two constraints: the High is linked to no more than two moras, and the stress-bearing foot is associated with tonal prominence. The remaining output forms do not violate Tone-to-Foot, but are offensive in other, more serious ways: (129b) violates AlignSFoot more seriously than (129a), (129c) violates SFootSalience, and (129d) violates HLink.

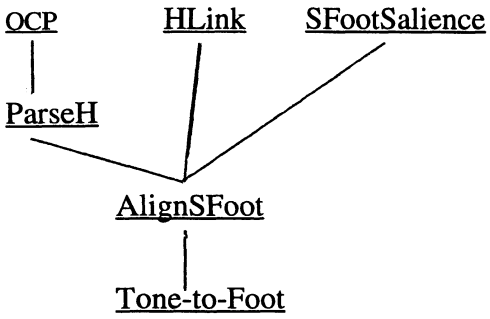
(129) Input: pa(raa)(dá)

	HLink	SFootSalience	AlignSFoot	Tone-to-Foot
» a. pa (raá) (dá)			*	*
b. paraa (dá)			* * !	
c. pa (raa) (dá)		* !	*	
d. pa (ráá) (dá)	* !		*	

The difference in stress patterns between toneless forms and those endowed with tone is only apparent under the present account, and is reduced to different interactions within the same set of constraints. To reiterate the point made earlier, it is due to the two opposing tendencies that play the central role in the NS stress system: the tendency to parse lexical tone towards the word's right edge, and the tendency to place stress towards the word's left edge (due to the AlignSFoot constraint). The tension is crucially due to SFootSalience, the constraint that governs the interface between the two systems, by requiring the presence of tone on the stress-bearing foot. This brings in the tone-related constraints which interfere with the requirement for initial stress.

The resulting interactions demonstrate that the set of purely tonal constraints, as well as SFootSalience, are undominated (with the exception of ParseH, dominated solely by tonal constraints), while the two foot-related constraints are dominated, and also ranked with respect to each other. The overall ranking is given in (130):

(130) Ranking:



This account explains a hitherto mysterious fact: vowel length is lost in syllables preceding the stressed one. The relevant examples, given in (111), are repeated below:

(131) a. majstóríja / *maajstóríja 'crafstmanship' (cf. maajstor 'craftsman')
b. dobošaárá / *doobošaárá 'drummer(Gen,Sg)' (cf. dooboš 'drum')

A plausible interpretation of the facts in (131) is that the stress-bearing foot may not be preceded by another foot. This can be reduced to what we already saw as a property of the stress system: the stress-bearing foot has to be leftmost in a prosodic word, if not outright initial and, as a consequence, no foot may occupy the pre-stress position.

This additional fact is explained solely in terms of the constraints proposed thus far, with the aid of the set of Parse constraints. Focusing on (131a), the first syllable in this form is the leftmost foot in the word by virtue of being heavy, and as such should be assigned the status of the stress-bearing foot, in accordance with AlignSFoot, as in (132). However, being toneless, it does not satisfy SFootSalience, and therefore does not constitute a licit stress-bearing foot:

(132) *(maaj) (stó) (rí) ja

Yet, any attempt to endow *maaj* with a High tone, in order to make it compatible with SFootSalience, results in violating one of the tonal constraints: (133) violates HLink since

tone is linked to three moras, (134) violates the OCP, and (135), in which lexical tone is left unparsed, is banned by ParseH.

(133) (maáj) (stó) (rí) ja

(134) (máaj) (sto) (rí) ja

(135) (máaj) (sto) (ri) ja

This is summarized in the following tableau. Note that each of the listed candidates violates at least one constraint that has been shown to be undominated, although all candidates are in full compliance with AlignSFoot, which is left out of the tableau.

(136) Input: (maaj)sto(rí)ja

	H-link	OCP	ParseH	SFootSalience	Tone-to-Foot
a. (maaj) (stó) (rí) ja				* !	
b. (maáj) (stó) (rí) ja	* !				*
c. (máaj) sto (rí) ja		* !			
d. (máaj) (sto) (ri) ja			* !		

It thus follows that no foot may precede the stress-bearing one, and indeed, no foot precedes stress in the wellformed candidate in (137):

(137) [maj (stó) (rí) ja]$_{PrWd}$

This is achieved by divesting the initial syllable of its foot status: its vowel is shortened, and therefore it fails to satisfy Foot Binarity. This form violates two constraints from the Parse family, Parse μ and Parse Syl, which require that moras be parsed into syllables, and syllables into feet (see Prince and Smolensky 1993). However, the alternative of footing the initial heavy syllable, but failing to parse the foot into the prosodic word, is not available:

(138) * (maaj) [(stó) (rí) ja]$_{PrWd}$

This is because (141) violates a third constraint from the Parse family, Parse Ft, which dictates that feet should be included into the prosodic word. As shown by the following

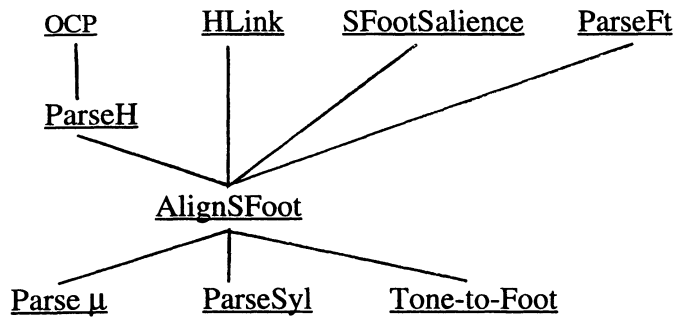
tableau, the requirement to parse feet ranks higher than either the requirement to parse syllables or moras:

(139) Input: (maaj) sto (rí) ja

	SFootSalience	ParseFt	AlignSFoot	ParseSyl	Parse μ
» a. [maj (stó) (rí) ja]$_{PrWd}$			*	*	*
b. (maaj) [(stó) (rí) ja]$_{PrW}$		* !			
c. [(maaj) (stó) (rí) ja]$_{PrWd}$	* !				

Thus, the stress-bearing foot is necessarily the leftmost foot within the prosodic word, even though it may not align perfectly with its left edge. Although the stress-bearing foot is tonal in form, it may not be preceded by any of the foot types, regardless of its shape. This follows from the following ranking between constraints from the Parse family and the stress-related set:

(140) Ranking (including Parse constraints):



I conclude therefore that no foot structure is permitted to the left of the stress-bearing foot, and that all syllables in this position have to remain unfooted. This raises the general issue of how exhaustively syllables are parsed into feet in NS, which we turn to in the following subsection.

4.2 Exhaustive parsing?

Exhaustive parsing is imposed more strictly in post-stress than in pre-stress position, due to the interference of AlignSFoot, which is of course irrelevant in the post-stress portion of the prosodic word.

In addition to (139a), we have encountered other cases of unparsed syllables. The forms in (124) and (129a), repeated in (141), possess an unparsed syllable in pre-stress position. The tableaux in (126) and (129) show that the candidates in which the corresponding syllables are parsed fare worse due to violation of higher-ranking constraints. This is due to the relative ranking between AlignSFoot and ParseSyl: the former ranks higher than the latter, as shown in (140) above.

(141) a. ti (rá) (ní) ja

b. pa (raá) (dá)

However, if it is indeed true that the stress-bearing foot may only be preceded by unfooted syllables, then two light syllables preceding the stressed one either do not form a foot, or if they do, this foot is not parsed into the prosodic word. In other words, the correct foot structure of (142) is either (143a) or (143b):

(142) protagónist

(143) a. [prota (gó) (nist)]$_{PrWd}$

b. (prota) [(gó) (nist)]$_{PrWd}$

As shown in the following tableau, (143a) is the correct representation. This outcome follows from the constraint ranking in (140), in which ParseFt ranks higher than ParseSyl. In other words, two unparsed syllables are less offensive than an unparsed foot. But if the two light syllables are parsed into a foot, and this foot is, in its turn, parsed into the prosodic word, the resulting configuration violates SFootSalience, as shown in (144c).

(144) Input: protago (nist)

	SFootSalience	ParseFt	AlignSFoot	ParseSyl
» a. [prota (gó) (nist)]$_{PrWd}$			* *	* *
b. (prota) [(gó) (nist)]$_{PrWd}$		* !		
c. [(prota) (gó) (nist)]$_{PrWd}$	* !			

Forms like those in (145) (see (131b)) are important in this context. Here, the stressed syllable is preceded by a heavy and a light, yet the heavy syllable is shortened.

(145) a. dobošaárá
b. *doobošaárá

If we assume that, due to their binary structure, heavy syllables fall under the jurisdiction of ParseFt rather than ParseSyl, then it follows that (145b) violates ParseFt (as well as ParseSyl), as in (146c), while (145a) violates either ParseFt, as in (146b), or ParseSyl on two counts, as in (146a).

(146) a. [dobo (šaá) (rá)]$_{PrWd}$
b. (dobo) [(šaá) (rá)]$_{PrWd}$
c. (doo) [bo (šaá) (rá)]$_{PrWd}$

The correct output is (146a), which violates ParseSyl on two counts, but satisfies the more highly ranked ParseFt, as shown in the following tableau:

(147) Input: (doo)bo(šaa) (rá)

	SFootSalience	ParseFt	AlignSFoot	ParseSyl	Parse μ
» a. [dobo (šaá) (rá)]			* *	* *	*
b.[(dobo) (šaá) (rá)]	* !				*
c. [(doo) bo (šaá) (rá)]	* !			*	
d. (doo) [bo (šaá) (rá)]		* !	*	*	
e. (dobo) [(šaá) (rá)]		* !			*

We now turn to the post-stress portion of the prosodic word, in which exhaustive footing is imposed more strictly than in pre-stress position. This is demonstrated by the following set of forms:

(148) a.	NomSg	(lá)(buud)/*(lá)bud	labud-	'swan'
	GenSg	(lá)(buda)		
b.	NomSg	(ví)(teez)/*(ví)tez	vitez-	'knight'
	GenSg	(ví)(teza)		
c.	NomSg	(jé)(lén)	jelén-	'deer'
	GenSg	(jé)(lé)na		

The forms in (148a) and (148b) are disyllabic, as well as bimoraic, toneless bases combined with inflectional endings (recall that these forms are subject to *-ov* augmentation). This set of forms demonstrates nicely the effect of the exhaustive parsing

of syllables into feet. The first syllable of the nominative singular is footed due to tonal association. The second (and final) syllable of this form is monomoraic; rather than remaining unfooted, this syllable is increased to the size of a foot, by virtue of overparsing a mora, and thus inducing a Fill violation; as a result, the entire form is parsed exhaustively into feet. No lengthening is observed in the genitive singular forms, in which the stress-bearing foot is followed by two light syllables, which correspond to a licit foot. Nor is any lengthening observed in (148c): this form is affiliated with lexical tone, and its base-final monomoraic syllable is therefore endowed with a High tone[28]. (Recall that, although bimoraic, this form is not subject to *-ov* augmentation, because of its tonal association.)

The tableau in (149) presents the candidate forms for (149a) above. Once the effect of AlignSFoot is out of the picture, violations of ParseSyl are not tolerated. FootBinarity, whose effect we saw in section 3, is again an important player: it eliminates the candidate form in (149c), and induces a Fill violation in the wellformed candidate (149a). This is because constraints on grouping override prominence in all feet other than the stress-bearing one, which is governed by SFootSalience, a prominence constraint of its own[29].

(149) Input: labud

	SFootSalience	Trochaic Quantity	FootBinarity	ParseSyl	Fill
» a. [(lá) (buud)]			*		*
b. [(lá) bud]			*	* !	
c. [(lá) (bud)]			* * !		
d. [(lá bud)]		* !			
e. [(labud)]	* !				

Forms with the suffix *-ost* further demonstrate the requirement to parse syllables exhaustively in the post-stress portion of the prosodic word.

(150) a. NomSg (lú)(doost)/*(lú)dost ludost- 'folly'
GenSg (lú)(dosti)

[28] Word finally, vowel length is allowed in closed, but not in open, syllables in this dialect; as a result, only *closed* word-final syllables are subject to vowel lengthening (see Ivić 1958, 1985).

[29] Note that the form in (149d) is ruled out due to a violation of TrochaicQuantity, which prohibits bimoraic feet associated with tone as a case of uneven trochees. However, this constraint may itself be violated, as shown by the wellformed (116a) and (117a).

b.	NomSg	(béz)(bóż)(noost)/*(béz)(bóż)nost	bezbóżnost-	'ungodliness'
	GenSg	(béz)(bóż)(nosti)		
c.	NomSg	(gluú)(póst)	gluupóst-	'stupidity'
	GenSg	(gluú)(pós)ti		

In (150a) and (150b) the final syllable of the nominative singular form, which follows a foot, is monomoraic and therefore unfootable; in both cases it is increased to the size of a foot, and as such included into prosodic structure, although the former case is a toneless form, and the latter a form with lexical tone. What the two forms have in common is that their final syllables are both monomoraic and toneless. This is not so in (150c), in which the final syllable of the nominative singular is monomoraic, yet associated with tone. Due to this latter property, this syllable corresponds to a foot, and is therefore included into foot structure[30].

In sum, exhaustive parsing of syllables into feet is seriously hampered only in the pre-stress portion of the prosodic word, due to interactions with AlignSFoot. This constraint thus accounts for the observed asymmetry between the underparse of moras in pre-stress position, and the overparse of moras in the post-stress portion of the prosodic word.

4.3 Justification for delegating stress to SLevel rather than MLevel

Here, I justify what has been assumed all along in the present section: that stress has to be associated with the SLevel. The MLevel cannot be taken as the basis for determining the locus of stress without risking major inconsistencies. Crucially, the prosodic distinctions between toneless forms and those endowed with tone, brought in relief in section 3, are obliterated by the presence of stress. It is therefore necessary to do what I have done in this section -- posit a distinct level within the grammar, the SLevel, to account for the stress facts.

Lexically toneless forms may be associated with conflicting, yet independently justified, foot structures at MLevel and SLevel. First, disyllabic forms which at MLevel are subject to *-ov* augmentation (see section 3.3) correspond to a single disyllabic foot:

(151) Before stress: (labu)dA [cf. labudov-]

30 Vowel lengthening in (148) and (150) has been attributed in the literature (Garde 1976:248; Belić1956:166-7; Leskien 1914:129-130) to the loss of the yer vowel in the nominative singular, on a par with the lengthening evidenced in monomoraic forms. These sources observe that accented syllables are not lengthened, the fact that is accounted for under the present analysis.

With the advent of stress, this footing is "disrupted." With the tone added, the foot in (151) is no longer in the set of licit feet. Foot structure thus ought to be "adjusted" as in (152), to comply with the High that comes in by virtue of stress.

(152) After stress: (lá)(buud) [not *(lábud)]

This inconsistency can be resolved by assuming that (151) is the MLevel footing, and (152) the SLevel footing, and that the two do not have to be compatible with each other. The same is observed with the forms which combine with *-ost*, in particular, those that are subject to trochaic shortening.

(153) Before stress: a. [[luud]$_{M1}$ ost]$_{M2}$ A]$_{MW}$
b. (ludost) M2 = Ft

(154) After stress: (lú)(doost)

Again, the footing in (153), in accordance with the prosodic constraint on the M2 constituent (see section 3.2), is incompatible with the footing in (154), imposed by stress. And again, the only possible resolution is associating stress with a level of its own, that is, with the SLevel.

Second, the minimal word facts, shown to be relevant at MLevel, are incompatible with the stress facts as well. In order to demonstrate this, we assume, erroneously, that the minimal word constraint and stress reside at the same level.

(155) Hypothetical scenario:

Before stress: [[rod]$_{M1}$ A]$_{MW}$

After stress: * (ród) MW = PrWd (i.e., MW ≥ Ft)

Under this assumption, all *stressed* monomoraic forms would equal a foot, due to the presence of a High tone which is concomitant with stress. In other words, stressed monomoraic forms would all satisfy the minimal word requirement, which would obviate the need for, say, vowel lengthening or any other type of increase in prosodic size.

Yet, in the actual case, monomoraic toneless forms do increase their size in order to satisfy the minimal word constraint, as in (156) (see also section 3.1).

(156) Actual scenario:

Before stress: a. [[rod]$_{M1}$ A]$_{MW}$
b. (rood) MW = PrWd (i.e., MW ≥ Ft)

After stress: (róod)

This incompatibility strongly suggests that the minimal word constraint and stress reside at different levels -- the former at MLevel, and the latter at SLevel.

In sum, the distinction between toneless forms and forms with their own tone is retained at MLevel but not at SLevel because the latter, but not the former, allows overparse of tone. At MLevel, no Highs other than those introduced by lexical forms are present, and any size constraint associated with this level will impose different foot types on toneless forms, and forms associated with tone. However, the overparse of tone neutralizes the distinction between these two sets of forms. In a non-procedural framework such as the version of Optimality Theory assumed here, mutually inconsistent phenomena of this sort have to be associated with distinct levels (cf. Goldsmith 1993; Prince and Smolensky 1993).

5. Concluding remarks

Several complex sets of NS facts, pertaining to prosodic morphology as well as stress, have been analyzed here in terms of a foot inventory which is a mixture of two foot types, one based on grouping, the other on tonal prominence. This is what makes NS a hybrid system. The data covered in this paper would in fact make little sense had only one of these two types been invoked.

In view of a hybrid system like this one, we might expect to find "pure" foot inventories based not only on grouping but also on prominence. On the empirical end, it would thus remain to be seen whether prominence-based foot inventories exist in a "pure" form, on a par with the well-attested inventories based on grouping. This however seems unlikely. What appear to be pure prominence-based stress systems, including the so-called unbounded systems (Prince and Smolensky 1993; Hayes 1995), or pitch-accent systems such as Lithuanian (as analyzed in Blevins 1992) and Golin, do not seem to require foot inventories. Access to a prominence hierarchy alone is in fact sufficient to characterize the prosodic properties of words in languages of this sort.

The obvious question, then, is under what conditions tonally prominent syllables are interpreted as feet. Here, I have proposed one possible scenario: due to their salience, syllables with tonal association may claim the foot status, on a par with binary

constituents resulting from grouping. It may well be, though, that this scenario is possible only if grouping is at least as relevant as prominence, and presents a mode of reconciling competing tendencies within a prosodic system.

6. References

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